Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

MARCH ★ 1953

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 123—Journal Section of The American Society of Heating and Ventilating Engineers

Dr. Raymond Hussey, Scientific Director, Council on Industrial Health, American Medical Association; Reg F. Taylor, President, The American Society of Heating and Ventilating Engineers; and Dr. Robert W. Keeton, Professor of Medicine, Emeritus, and a member of the ASHVE Committee on Research, observe display demonstrating physiologic adjustments of people to sudden changes in environment

..... *see page 104*

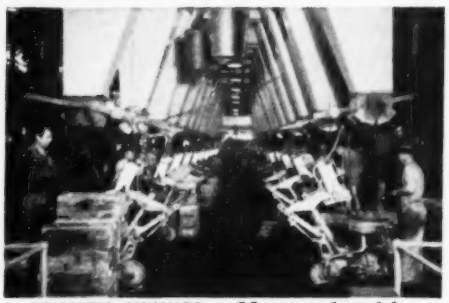
COMPLETE CONTENTS OF THIS ISSUE ..... PAGE 5

WHY you can depend on GRINNELL PIPE FITTINGS to suit you to a

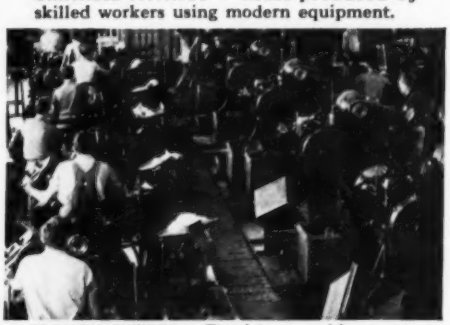
Superior Quality, Complete Line, Available Coast-to-Coast

The finest materials, equipment and methods are employed in the manufacture of the *complete line* of high quality Grinnell malleable iron and cast iron pipe fittings. Branch warehouses and distributors, located from coast-to-coast, make local stocks as convenient as your telephone.

The same can be said about superior quality and ready availability of Grinnell Steel Nipples. Top grade, new pipe only is used. Controlled manufacture assures accurate chamfer for quick starting; precision threads for easy running-up and tight joints.



GRINNELL FITTINGS — Mass-produced by skilled workers using modern equipment.



GRINNELL NIPPLES — Precision machines produce accurate threads and proper chamfer.

PACKED IN CARTONS — You are assured easier handling, storage and identification.

When Ordering, Specify Grinnell Malleable Fittings and Steel Pipe Nipples *in cartons* . . .

Both Grinnell malleable iron fittings and steel nipples are available in cartons.* On the shelf or on the job, *cartoned* fittings and nipples offer a number of advantages, at no extra charge:

- Faster and cleaner handling
- Cleaner stocks for resale and use
- Threads protected against damage
- Simplified storage and shipping
- Contents quickly identified by labels
- Greater accuracy in filling orders

***Grinnell Malleable fittings also come in small and large bags.**

Call Your Local Grinnell Distributor

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

RK (är' kā') abbrev. of Refrigerated Kooler-aire. Trademark of United States Air Conditioning Corp. Spec., one central station package unit comb. all elements of built-up systems. Delivered ready for installation; hence a money-saver in initial cost, floor space and maintenance. Has Evaporative Condenser, which continually recirculates water, saving 95% of water consumption. Chief function of RK is to deliver more cooling per dollar of operation. Available in 10 sizes, 3 thru 50 H.P. capacities.
RK (Refrigerated Kooler-aire) 1. Conditioner consists of blowers, cooling coil & control panel. 2. Compressor Section—houses compressor and motor. 3. Evaporative Condenser.

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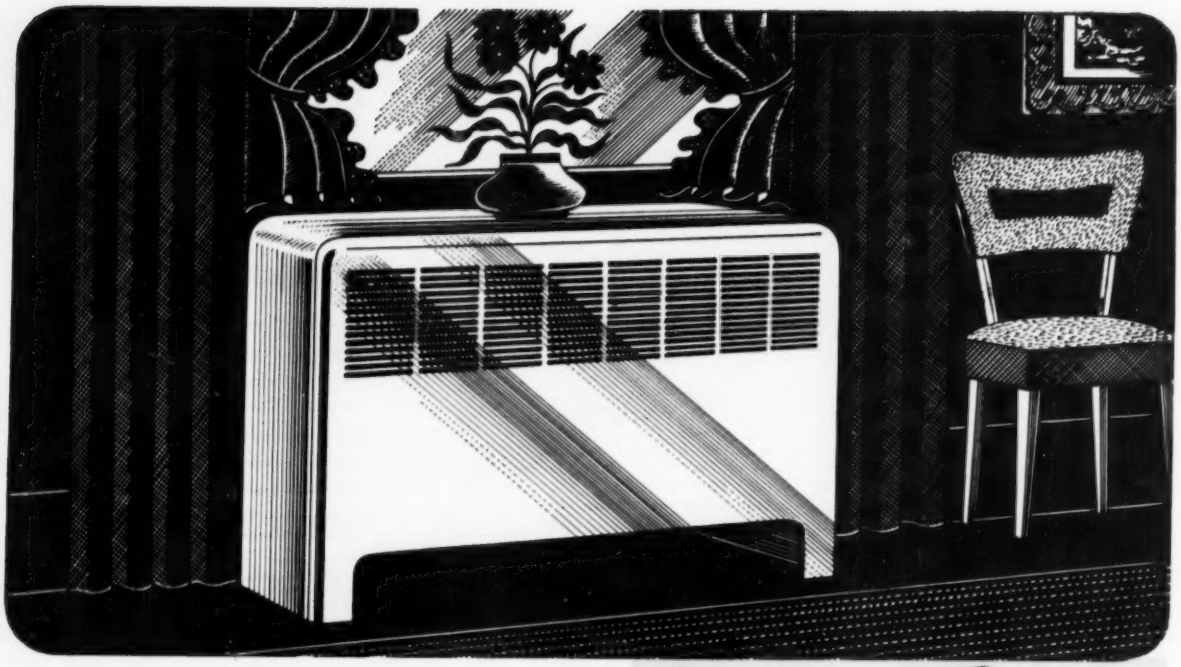
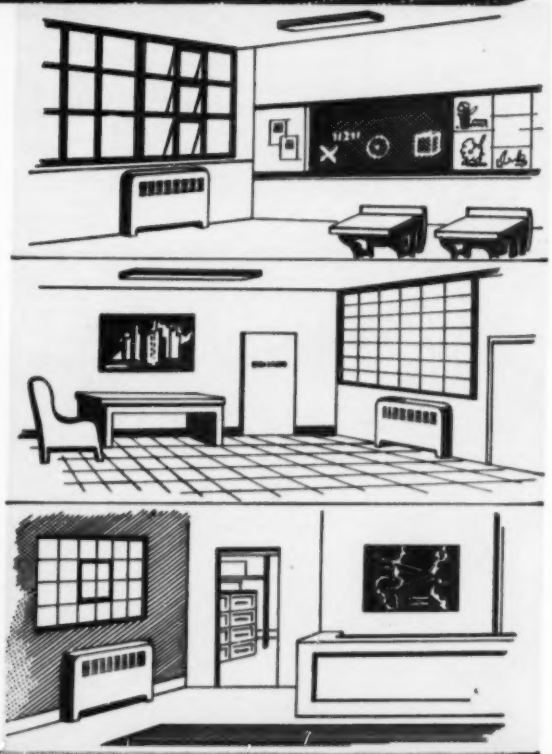
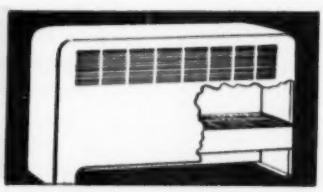


Streamlined Efficiency

Modern business is of necessity streamlined for utmost efficiency. Thus it is, to satisfy the demands of heating men everywhere, and to keep pace with this trend, that Bush offers their convector radiator. Universal two pipe nonferrous elements (one pipe available in special element) and heavy gauge steel enclosures suitable for free standing or semi-recess, supply the modern touch to the heating installation. The completely removable front panel simplifies the installation and piping problems. Required pitch is easily obtained by a screw adjustment at either end of the element. Complete units are packed in individual cartons greatly reducing the storage and handling problems. A truly modern, functional unit that demands your attention and commands your respect. Write for Bulletin No. 545 for complete information.



Cutaway view showing element location and case construction.



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Heating Piping & Air Conditioning

Vol. 25 No. 3

MARCH 1953

(with which is merged the Aerologist)

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Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $3.00 per year; Canada, Cuba, Mexico, Central America, South America, $4.00 per year; other, $6.00. Current copies, U.S. and possessions, 35c each; back copies, 60c each. January 1953 issue $1.50 per copy. For change of address, notify publisher and your local postoffice of both old and new addresses by the 15th of the preceding month. Member Audit Bureau of Circulations, Associated Business Publications, Inc., and Magazine Publishers Association, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc., and Industrial Arts Index, and is microfilmed by University Microfilms.

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Entered as Second Class Matter May 18, 1929 at the postoffice at Chicago, Ill., U.S.A. under the Act of March 3, 1879. Additional entry at Mendota, Ill.

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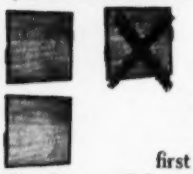
HOW TO CUT YOUR AIR FILTERING COSTS 1/3!

If you are not using FAR-AIR* filters – you may be paying 33⅓% too much for air filtration!

HERE'S WHY...

FAR-AIR filters with their many exclusive design features are the first and original high velocity air filters. Each unit is engineered to hold *more* dirt, handle *more* air with *less* pressure loss and give *greater* efficiency than other impingement filters. This means that your maintenance and installation costs are drastically reduced–so much so, that it probably will pay you to replace your present filters with FAR-AIR.

1/3 SPACE SAVING



Because these filters handle 50% more air per unit with less pressure loss, two FAR-AIR filters will do the work of three ordinary types. You make substantial savings in first cost through smaller plenum chambers and fewer filters and holding frames.

CUT MAINTENANCE UP TO 60%

FAR-AIR filters hold more dirt per unit without decreased efficiency, so maintenance is cut approximately ⅓. Also, due to the media design, they can be cleaned by simply flushing with a hose.

These filters can even be cleaned and reoiled without removing them from the filter bank! All these points add up to less maintenance time and cost than you would believe possible.

"LIFETIME ENGINEERING" SAVES YOU MONEY

Extra quality in construction allows these filters to far outlast ordinary types. Sixteen gage steel filter and holding frames assure well-aligned, rigid filter banks. Reinforcing rods drilled through the media make distortion virtually impossible. Felt linings prevent air bypass. Firmly packed media provides even density and assures uniform high efficiency over the entire filter area.

EXCLUSIVE PROGRESSIVE LOADING FEATURE GIVES YOU MORE EFFICIENT FILTERING

The famous herringbone-crimp design of the media allows the filter to load with dirt progressively through the entire filter, not just on the face. There is exceptionally low pressure loss even on a fully loaded filter because channels in the media allow passage of air. You get more efficient filtering over a longer period of time as a result.

OTHER FAR-AIR PRODUCTS INCLUDE:

SELF-WASHING FILTERS
KITCHEN GREASE ELIMINATORS
ENGINE AND COMPRESSOR FILTERS
ROTARY (EVAPORATIVE) COOLERS
AIR BAFFLE EQUIPMENT
FILTER SERVICING EQUIPMENT

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Mail the coupon, today!

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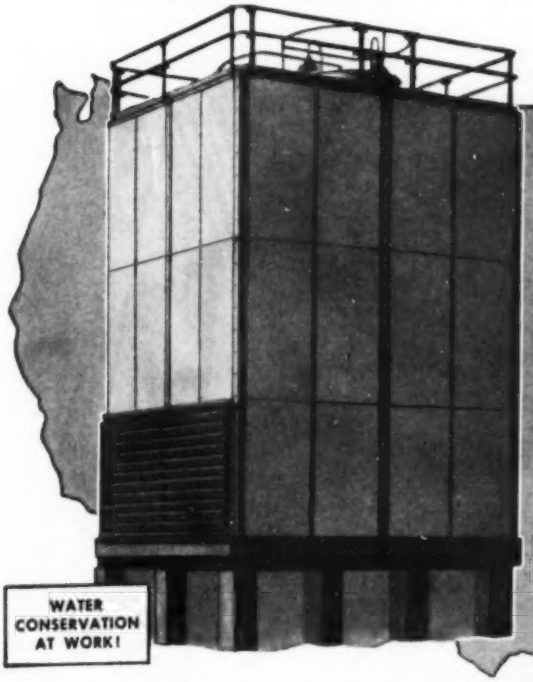
So take advantage of Pritchard's ability to design, fabricate and install the quality cooling tower that completely satisfies your most rigid requirements.



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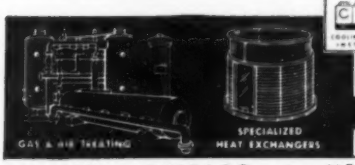

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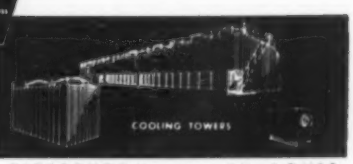

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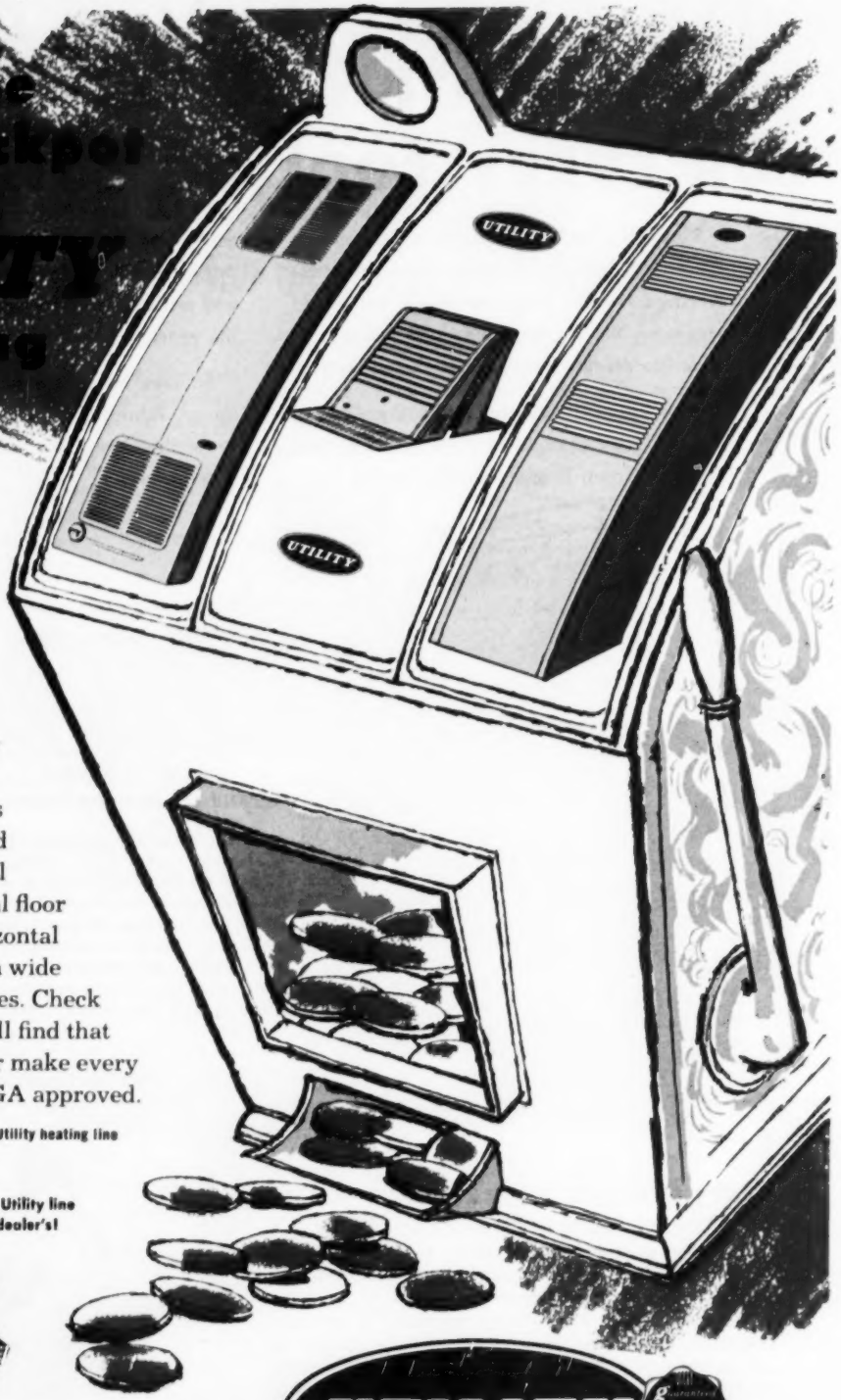

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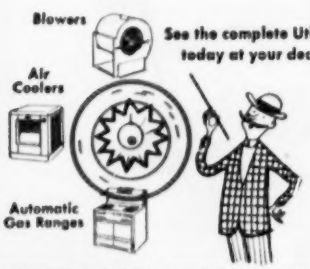

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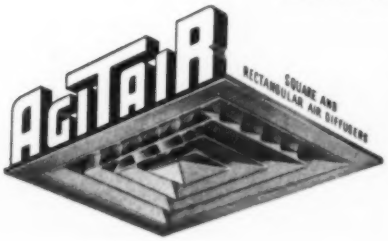
Architects can plan for today, and be prepared for tomorrow, by specifying AGITAIR "RC" air diffusers—with removable, interchangeable cores. Mounting frames are permanent, attractive . . . come in three distinct styles to meet all job conditions. When partitions are relocated, changes in frames or duct work are not necessary. New AGITAIR diffuser core will suit changed requirements perfectly.

Engineers will find, in this new, removable core for square and rectangular units, all the features that made the original AGITAIR Type "R" air diffusers so popular. These exclusive advantages include patented, built-in diffusing vanes . . . custom-made and assembled in a wide range of patterns and sizes . . . 100% control of volume and direction of discharge in areas of any size or shape. No makeshift blanking required. Unlimited application flexibility.

Contractors can save installation time and labor costs . . . thanks to the new AGITAIR "RC" Series. Now only two simple steps are required. 1. Attach mounting frame to duct. 2. Insert diffuser core and lock into position. No loose hangers . . . no loose screws, nuts or bolts to get lost. Units are delivered with built-in slip hinges, slots and mounting lock. It's just *presto . . . changeo!*

For latest technical data, contact your local AGITAIR representative, or write us today.

The vanes make the difference



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TYPE RC . . .
For Standard Installations

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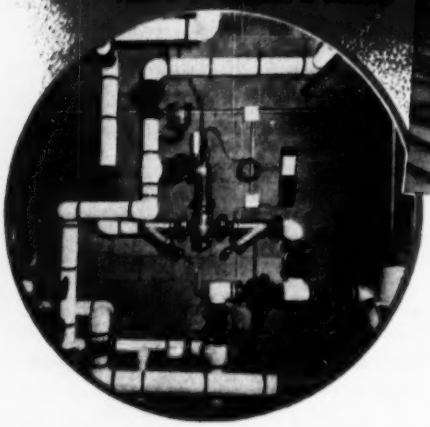
For Drop Frame Installations

TYPE RCTC . . .
For Tile Ceilings

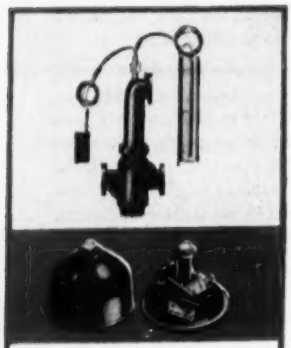
Sarcotherm

chosen for POTDEVIN MACHINE COMPANY'S LARGE PLANT at Teterboro, N. J.

86,000 ft. of steel pipe are arranged in serpentine coils for the radiant heating system. Heating Contractor, Frank Lawton, Paterson, N. J



One of the 5 Sarcotherm Control valves, protected by strainers. A Sarcotherm Air Eliminator will be noted at the right.



The heart of the Sarcotherm control system is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.

The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

This latest addition to the industrial plants at Teterboro terminal covers an area of 102 thousand square feet.

The single story building is radiant heated by floor coils requiring 86,000 feet of pipe.

The system is divided into five zones, each controlled by a 3″ Sarcotherm Control Valve, type STA-1D, with Thermoray heat-loss thermostat for each zone.

Sarcotherm also furnished Sarcoflow balancing fittings, access boxes, strainers and other accessories.

This is the largest single story industrial building in the East, radiant heated by floor coils.

We are proud that

Sarcotherm Control

was selected for this outstanding job. Individually engineered Sarcotherm Control systems are available also for conventional forced Hot Water or Steam Heating Systems. Our Engineering Department will be glad to assist on your next job.

24

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SARCO saves steam

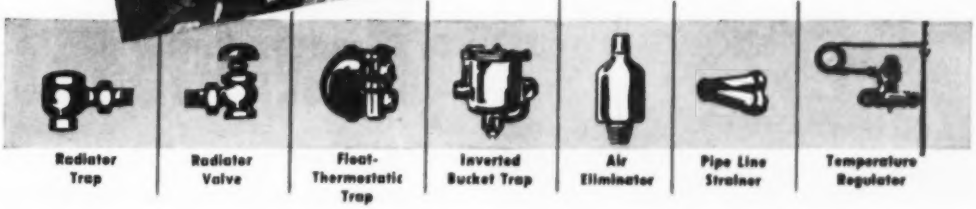
sarco quality assures satisfaction

1. Air conditioner in basement. Air heating coils and drips fitted with Sarco float-thermostatic steam traps.

2. Office Building of Kaighin & Hughes Inc., Toledo. This leading heating and piping contractor recommends Sarco Heating Specialties and uses them in his own office building and shop.

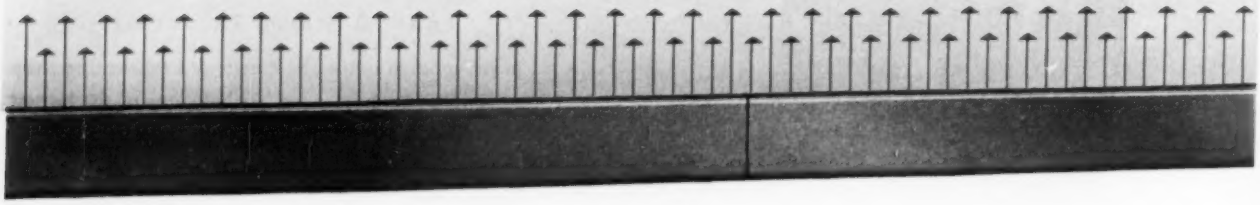
3. A corner of the large drafting room of Kaighin & Hughes Inc., large heating and piping contractor in Toledo.

4. A view in the extensive pipe fabricating shop of Kaighin & Hughes, Inc., Toledo. Sarco heating specialties are both used and recommended by this contractor.



417

NEW! Trane Unit Ventilator 40-foot blanket of FORCED,



HEATS MORE EVENLY . . . ends cold corners

VENTILATES MORE UNIFORMLY . . . ends stale spots

STOPS DOWN-DRAFTS CONSTANTLY . . . ends window chill

No other unit ventilator ever built can blanket the entire outside wall with a forced upward flow of tempered air, providing better heat and air distribution and also protecting children from down-drafts, even when the heat is off!

Big news! A really basic engineering improvement in unit ventilator development . . . the new TRANE Unit Ventilator System! Architects, engineers, contractors, manufacturers and school boards have long agreed that the ideal unit ventilator would blanket large window areas with a *continuous*, forced stream of tempered air.

Now TRANE product engineers have actually built a unit that accomplishes the ideal . . . *constant* perimeter heating with individual unit control. Now you can have a classroom ventilator that will stop window draft with an upward moving blanket of tempered air. Do it *every minute the room is occupied.* Do it quietly.

Here's how it works: Part of the warmed air delivered by the new TRANE Unit Ventilator is forced out through two wings. This scientifically designed, easily installed ductwork distributes air uniformly along the entire wall. Special fans in the unit ventilator keep this air under pressure . . . forcing it *constantly* and *evenly*, even when the thermostat calls for no heat. Yes, it protects school children from drafts *even when the heat is shut off!*

The new TRANE Unit Ventilator blends room and outside air, tempers it with just the right amount of heat, and distributes it *evenly* throughout the room . . . eliminates cold corners and stale air spots for good!

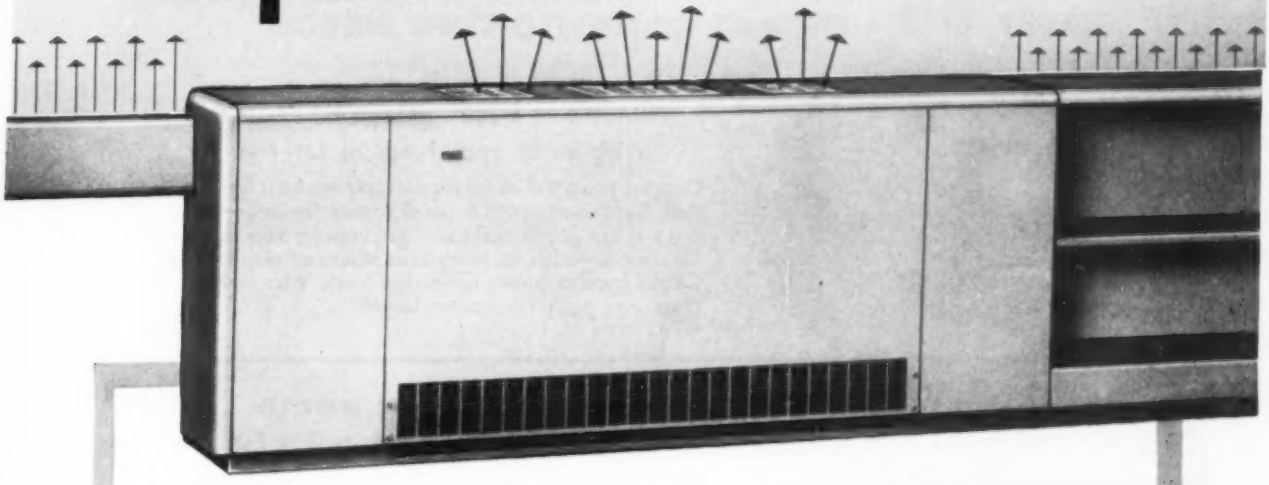
No other unit ventilator system can deliver such constant, even distribution of heat and ventilation air . . . plus complete protection against window drafts.

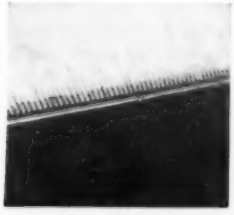
For more details, contact your TRANE sales office, or write TRANE, LaCrosse, Wis.

New TRANE

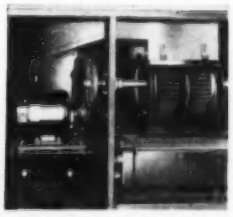
MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR

delivers continuous tempered air *[even when heat is off!]*

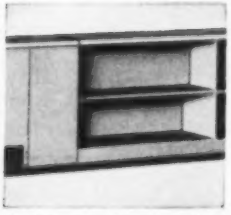




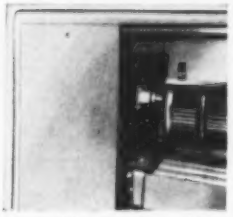
Laboratory photo of smoke test shows how this new idea works. Blanket of warm air moves upward from ducts in an even, solid stream. Drafts can't penetrate. Ducts come in 5-foot lengths, with a maximum extension to 15 feet from each side.



Exclusive fan, motor arrangement. Low velocity fans deliver air out through ducts, others move air through top of unit. Exclusive shaft and bearing assembly assures quiet operation. Standard motor, rubber mounted to stop noise.



Shelving optional—the new TRANE Unit Ventilator's ducts fit neatly into handsome, easy-to-install, bolt-together shelving. You can choose standard units in either open or closed shelving with a continuous, smooth top surface.



Removable panels—give easy access to all 3 sections. Front of each fan scroll detaches for easy cleaning. Filters are easy to replace or clean. Controls can be adjusted with panel in place, with unit in operation . . . a TRANE exclusive.

A great addition to TRANE's complete line of school heating and ventilating equipment

Centrifugal Fans

Heating Coils

Wall-Fin

Convectors

Unit Heaters

Unit Ventilator System

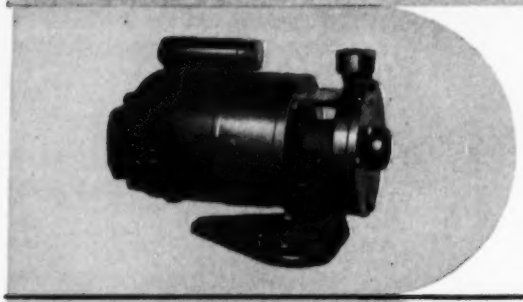
smothers every inch of draft . . . every minute of the day!

CONDITIONING EQUIPMENT The Trane Co., La Crosse, Wis. • East. Mfg. Div., Scranton, Pa. • Trane Co. of Canada, Ltd., Toronto • 80 U.S., 14 Canadian Offic

ALLIS-CHALMERS
Air Conditioning
PUMPS

Easy-to-Install pumps

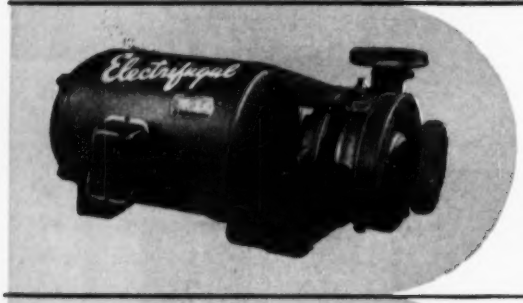
MEET 90% OF AIR CONDITIONING NEEDS



FHP pump

Up to 80 gpm, heads to 125 feet.

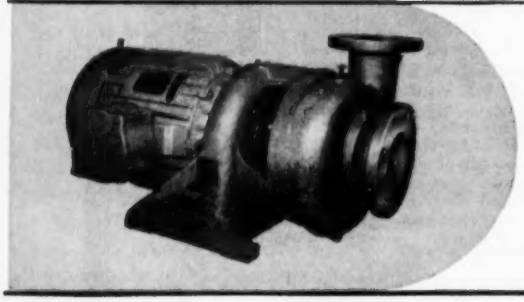
Compact pump and motor requires only two bolts for installation. Rigid construction holds alignment for longer bearing and seal life. Mechanical seal. Open impeller economy model does adequate job on many installations at very low cost. Closed impeller model for higher heads. Also available as frame-type pump for separate mounting.



Electrifugal pump

Up to 500 gpm, heads to 220 feet.

Only pump with unit-cast frame. Motor and pump are mounted on a single shaft in a one-piece rigid cast-iron frame. Alignment is rigidly held but there is plenty of space for maintenance. Installation requires only four bolts. Standard packing or mechanical seal available. Also built as frame-type pump for separate mounting.



Supporting adapter pump

Up to 2500 gpm, heads to 550 feet.

Flange motor and pump mounted on sturdy cast-iron supporting adapter. Motor and pump use same shaft. Rigidity assures vibrationless operation and long bearing life. Only four bolts required for installation. Available with standard packing or mechanical seal. Built in same ratings as frame-type pump for separate mounting.

FREE ENGINEERING HELP

YOUR ALLIS-CHALMERS PUMP REPRESENTATIVE is thoroughly familiar with pump problems in air conditioning equipment. He can offer you valuable suggestions in planning your equipment and installations. Call your Allis-Chalmers Authorized Distributor or District Office when you need help with your pump problems.

Write Allis-Chalmers, Milwaukee 1, Wisconsin, for centrifugal pump Bulletins 52B7529, 52B6140 and 52B6083 describing these air conditioning pumps.

A-3971

Electrifugal is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

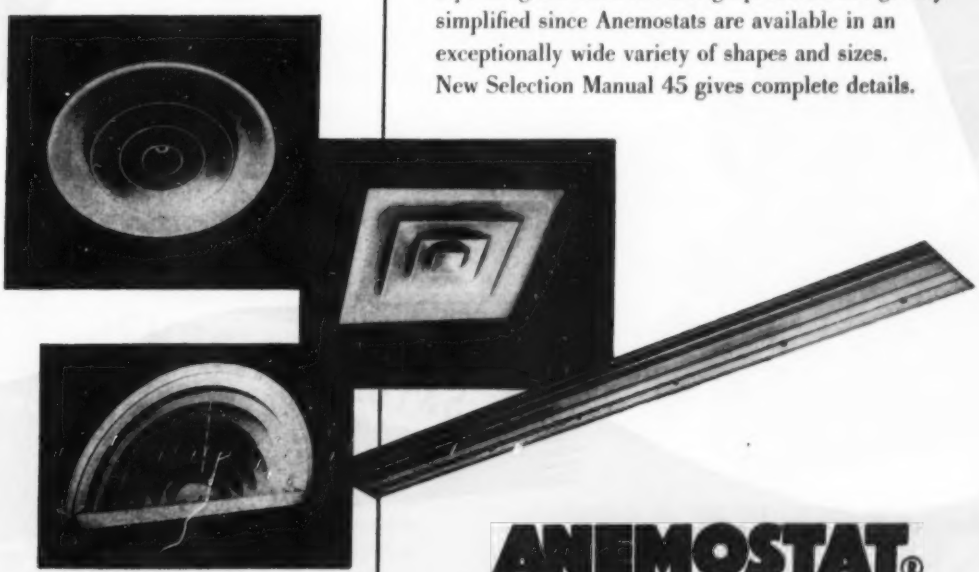
For top performance

THERE IS NO "OR EQUAL"

When you specify Anemostat Air Diffusers there is no "or equal."

Top Performance is not an accident. Anemostat Corporation of America has pioneered the manufacture of quality air diffusers, has established standards to assure proper air distribution, and diligently continues research and development for the benefit of the industry which it serves.

Since no air conditioning system is better than its air distribution, it is important to make sure that you provide draftless conditions with Anemostat *aspirating* air diffusers. Design problems are greatly simplified since Anemostats are available in an exceptionally wide variety of shapes and sizes. New Selection Manual 45 gives complete details.



ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

WHICH Type heating pump do you require ?

Type CV Vertical Pump

This pump requires a minimum amount of space for installation — Ideal for returning condensate to the boiler or other points with a maximum amount of efficiency — Capacities ranging from 500 to 10,000 sq. ft. EDR and discharge pressures from 10 to 20 lbs.

(Pumps are designed in both single and duplex units)

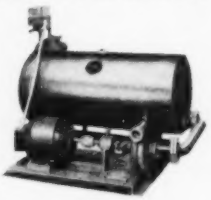
There's no need for our heating pump experts to fit your job to a limited line —

Skidmore offers a wide range of types and sizes for each and every heating installation. Balanced design assures perfect pump performance with maximum operating economy.

Just as important is the fact that Skidmore has been a leader in heating pump manufacturing for over 25 years. See a Skidmore representative today! or write Skidmore Corporation, St. Joseph, Michigan.

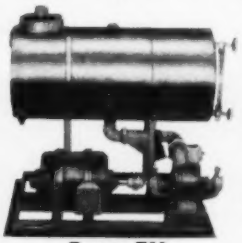
Type UV

Capacities ranging from 2,000 to 40,000 sq. ft. EDR and discharge pressures from 10 to 75 lbs.



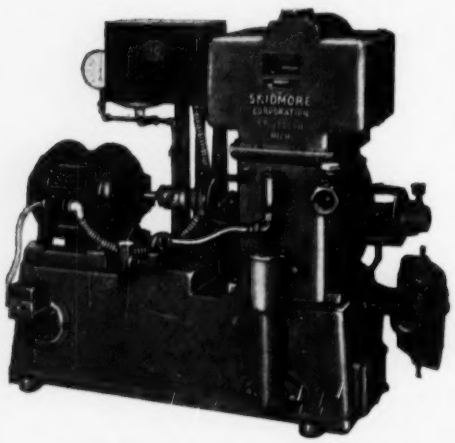
Type HS

Capacities ranging from 1,000 to 65,000 sq. ft. EDR, discharge pressures from 10 to 75 lbs.



Type TM

Designed for boilers up to 250 H.P. and discharge pressures up to 150 lbs.



Skidmore Vacuum Pump

Characteristic features of construction and operation eliminate the necessity of close clearance between moving parts — consequently, Skidmore Vacuum Pumps remain constant year after year without adjustments or expensive repairs — Capacities range from 5,000 to 100,000 sq. ft. EDR.

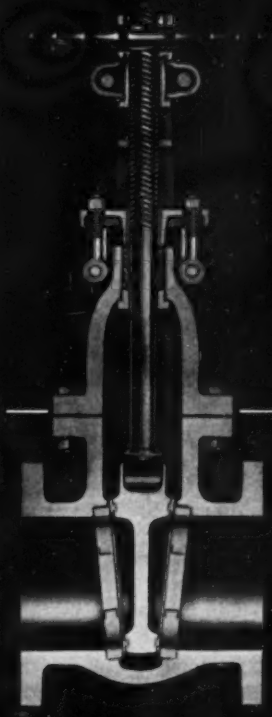
GET THESE BULLETINS

Bulletin No. 21 — Type CV Vertical Pump.
Bulletin No. 9-B — Vacuum Pumps.
Bulletin No. 19-A — Type UV Pump — for below floor level returns.
Bulletin No. 14-A — Type HS Condensate Pump.
Bulletin No. 17 — Type TM Turbine Pump.

SKIDMORE PUMPS *For Every Requirement*

SKIDMORE CORPORATION

ST. JOSEPH, MICHIGAN



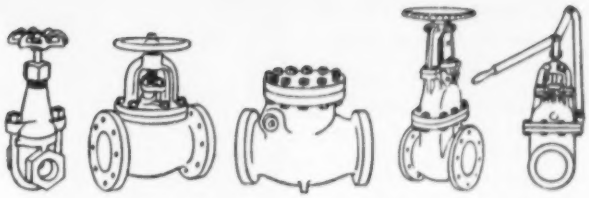
IRON

COMPLETE LINES OF IRON VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of types, pressure ratings, sizes, and patterns for general industrial use.

Walworth also manufactures complete lines of valves (including Lubricated Plug Valves), and pipe fittings made of steel, bronze, and special alloys.

These valves and pipe fittings, plus Walworth-made pipe wrenches total approximately 50,000 items and are sold through distributors in principal centers throughout the world.

Walworth engineers will be glad to help you with your problems. For further information call your local distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Iron valves in gate, globe, angle, check, and lubricated plug types are manufactured by Walworth. Illustrated is a sectional view of a Walworth No. 726F Standard Iron Body, Bronze Mounted, Wedge Gate Valve with flanged ends. This line of valves is available in sizes 2 to 30 inches. Similar valves of All-Iron type are also available.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

How Honeywell Customized Temperature Control can help solve the heating problems of the nation's churches

Specially designed Honeywell system provides superior comfort, saves fuel in Denver's new Messiah Lutheran Church

For a good many years, churchmen have been faced with several of the most difficult of all heating control problems.

How do you regulate the heat of a church so that its main areas are not uncomfortably hot on worship days when the gathering is large? How do you make sure it won't be too cold when bad weather keeps attendance down? And during the week, how do you maintain comfort in offices and auxiliary rooms without heating the whole building?

The way these problems have been met—by Honeywell Customized Temperature Control—in the Messiah Lutheran Church in Denver may well serve as a model for the rest of the nation.

For today, with ten Honeywell thermostats controlling seven temperature control zones, (the seventh, a perimeter zone, is not shown on the floor plan), all areas of the Messiah Lutheran Church are comfortable all the time. And fuel consumption is held at an economical level.

Six thermostats control comfort in two zones of nave

The area embracing the altar, choir section, and front portion of the nave proper is included in one zone. Here one thermostat controls the radiant floor panel while two others, on either side of the altar, control the heating and ventilating system discharging at the grilles shown in the ceiling. The rear part of the nave and the chapel are controlled as a separate zone. Also in this area, two special electric thermostats regulate the temperature of the organ pipes in each organ chamber to guarantee proper tuning.

Architect:
Raymond Harry Ervin, Denver
Mechanical Engineers:
Marshall & Johnson, Denver

This photo of the exterior of the Messiah Lutheran Church gives a good idea of the clean architectural lines of the building, which was designed by Denver architect Raymond Harry Ervin. Also, it shows the wide variety of weather exposures of the structure. But Honeywell Customized Temperature Control as easily compensates for strong northern winds as it does for sunshine on a bright winter day.

For comfortable, even temperature in new or existing buildings – of any size – specify Honeywell Customized Temperature Control

Whether it's a church, school, office, factory, hospital, apartment, store, garage – or any size building – new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate" – and save fuel besides.

And with a complete line of pneumatic, electric and electronic controls to choose from, Honeywell Customized Temperature Control offers you the greatest flexibility in design. Then, too, when it comes to performance, Honeywell-built controls assure years of trouble-free operation. And they're backed by the finest service organization in the controls industry.

For information on Honeywell Customized Temperature Control, call your local Honeywell office. There are 104 across the nation. Or mail the coupon today.

MINNEAPOLIS
Honeywell

First in Controls

And this view of the upstairs nursery shows how well the younger set fares at the Messiah Lutheran Church. A separate Honeywell thermostat here can be adjusted to compensate for weather conditions and the number of children in attendance. Temperatures are usually kept warmer here – a turn of the dial on the thermostat takes care of that – so youngsters won't be exposed to drafts on the floor.

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-3-45, Minneapolis 8, Minnesota

Gentlemen:
I'm interested in learning more about Honeywell Customized Temperature Control.

Name .....

Firm Name .....

Address .....

City ..... *Zone* ..... *State* .....

CONTROL PIPELINE MOTION
this dependable, maintenance-free space-saving way

6" I.D. Flexon dual controlled flexing expansion joints on 300 psi steam lines and 3" I.D. dual Flexoniflex units on condensate return line.

with FLEXON EXPANSION JOINTS

Eliminate the dangers of pipeline motion easily and permanently by installing Flexon Expansion Joints. These units are compact and easily installed. They can not leak and require no packing or maintenance of any kind. Just install them and forget them.

Flexon Expansion Joints are offered in three types—Free Flexing in copper or stainless steel for pressures to 30 psi—Controlled Flexing in copper or stainless steel for pressures to 300 psi—High Pressure Flexoniflex units in stainless steel for pressures to 5500 psi. All stainless steel pressure carriers withstand temperatures to 800° F. (1600° F. with special alloys). Copper models pressure and temperature rated according to code. All models are suitable for handling radial, axial and/or lateral pipeline motion.

Write for the name of your nearest Flexon representative.

Complete specifications on expansion joints to meet your needs are given in the new Flexon Expansion Joint Bulletin. Write for your copy today or see Flexonics Expansion Joint Catalogs in Sweet's, Chemical Engineering Catalog and The Refinery Catalog.

Flexonics *Corporation* EXPANSION JOINT DIVISION 1352 S. THIRD AVENUE · MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies products that served industry for over 50 years.

Flexible metal hose

Expansion joints

Aircraft components

Metallic bellows

Carrier
self-contained WEATHERMAKER
equipped with ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

Why are Allen-Bradley automatic starters so popular for refrigeration and air-conditioning service? . . . Because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

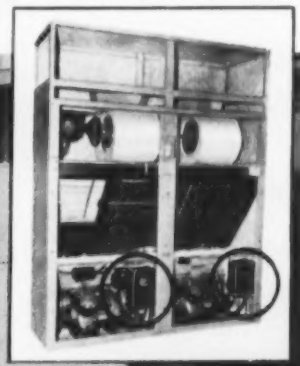
No contact maintenance . . . Allen-Bradley cadmium silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

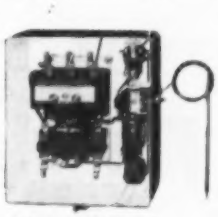
Close-up of interior of Carrier Weathermaker, showing the three reliable, trouble free Allen-Bradley Controls.



Carrier self-contained Weathermaker, equipped with Allen-Bradley Controls, installed in an egg storage plant. Simplicity of design is the key to the leadership position of Allen-Bradley Controls.

ALLEN-BRADLEY SPECIAL REFRIGERATION CONTROL UNITS

Allen-Bradley offers a wide line of air-conditioning and refrigeration controls—pressure and temperature controls, manual and automatic starters, and special refrigeration control units. The two units at the right show Allen-Bradley special refrigeration control units consisting of solenoid starter, high pressure cutout, thermostat, and manual starting switch. A-B Controls are trouble free.

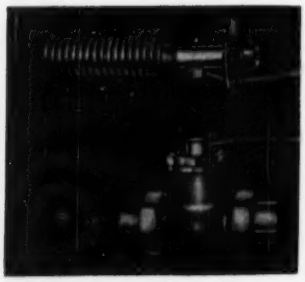


Bulletin 709 Size 2 Starter Unit

Bulletin 709 Size 1 Starter Unit

ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

DIAL COMFORT



Sylphon Control 928-C. Convenient manner of adjustment. Connecting tube length as required. Suitable for steam pressures up to 15 lbs.; other types available for pressures up to 75 lbs.

...with Sylphon Control

● Put Sylphon Temperature Regulators to work in office buildings, plants, aboard ships—and they maintain temperature *exactly* as wanted. They do it thriftily, too—rooms are never too hot, never too cold.

No. 928-C, pictured here, is just one of the family of Sylphon "comfort regulators." It's ideal for modulating control of air temperature in ducts. Simple and compact, it is highly sensitive to slightest temperature changes.

Its packless valve eliminates service problems. No exposed operating mechanism. Especially suited for installation in ordinarily inaccessible locations. Self-powered . . . sturdily built to operate faithfully for years.

Find out how No. 928-C, or other Sylphon Regulators, can help assure controlled comfort at *all* times. For complete details, write for Catalog EH-50

Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON
DIVISION

FIRST WITH BELLOWS

ROBERTSHAW-FULTON CONTROLS CO., KNOXVILLE 4, TENN.

Canadian Representatives, Darling Brothers, Montreal

it's SPANG® CW in the new Medical Research Building

Down Atlanta-way the weather varies from hot and humid in summer to wet and chilly in winter. To provide complete comfort for study and research all year around in these weather conditions, Emory University in Atlanta's suburbs installed a complete heating and air conditioning system in its new Woodruff Memorial Building for Medical Research.

In a building where such activities as cancer research and studies on cardio-vascular diseases and virus infections take place, the best equipment and facilities are a "must." And that includes the heating and air conditioning system. That's why Spang CW Steel Pipe was specified throughout the entire six-story building.

Spang CW Steel Pipe is quality controlled in its manufacture from the careful selection of top-grade skelp . . . through close metallurgical control during forming . . . to the finished product which is *doubly* inspected to assure you of a reliable product made for years of dependable service.

Contractors and builders know that the quality-control process used on Spang pipe means easy cutting, easy threading, easy bending and a faster and lower-cost installation. Why not take advantage of this superior pipe?

Don't just order pipe—tell your local distributor you want Spang CW Steel Pipe. You'll be glad you did!

Owner: Emory University, Emory University, Ga.
Architects: Robert and Company, Associates, Atlanta, Ga.
General Contractor: Barge-Thompson Company, Atlanta, Ga.
Piping Contractors: Stephenson Company, Inc., Atlanta, Ga.

SPANG

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

You can put full confidence in them!

THESE McQuay REPRESENTATIVES

No. 2 of a series of 3 advertisements.

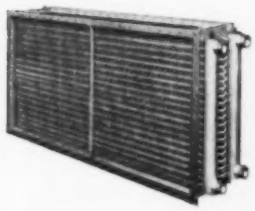
McQuay INC.

MAKE THE SEASONS COME TO YOU

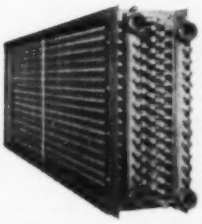
HEATING
REFRIGERATION
AIR CONDITIONING

1601 Broadway St. N. E., Minneapolis 13, Minnesota

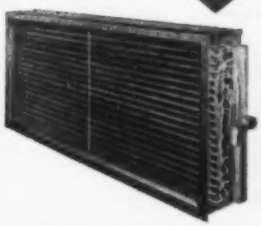
THIS COMPLETE LINE OF FAMOUS McQuay PRODUCTS



WATER COIL



CLEANABLE TUBE WATER COIL

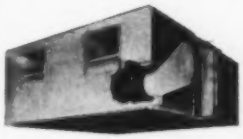


DIRECT EXPANSION COIL

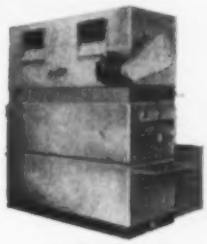
"BLAST" HEATING STEAM COIL

SEASONMAKER (FLOOR)

"RH" AIR CONDITIONER



AIR CONDITIONER
(Suspended Model)



AIR CONDITIONER
(Floor Model)

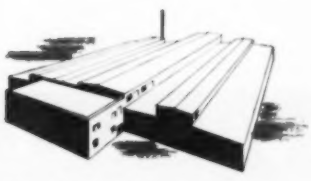
HORIZONTAL UNIT HEATER

DOWN FLOW UNIT HEATER

BLOWER TYPE UNIT HEATER
(Suspended Model)

BLOWER TYPE UNIT HEATER
(Floor Model)

McQuay representatives, in all principal cities throughout the United States, are qualified by long experience and training to help you satisfy all of your air conditioning and heating requirements. For cooperation in making the sale, technical advice, or getting the job done on time, consult the McQuay representative in your territory. Available to you through him is the complete line of McQuay products, featuring famous Ripple-Fin construction—a McQuay exclusive, assuring maximum heat transfer efficiency and dependable performance.



PLANT 1—1600 Broadway N. E.
MINNEAPOLIS 13, MINN.

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MINNEAPOLIS 13, MINN.

PLANT 3—4th and Park Ave.
FARIBAULT, MINN.

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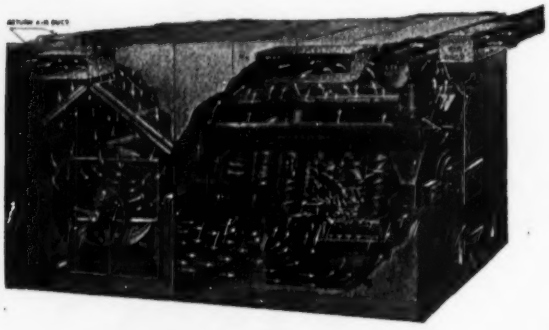
Christian Church, Eureka, Ill.; Herbert A. Brand, Chicago, Architect. Successfully heated with a single Campbell unit since 1934.

First Choice for Church Heating

On your next large church heating job, build your plans around a Campbell 8000 Warm Air Heater. Campbell Heaters are famed for outstanding performance and economy in large, multiple-room buildings such as the church shown above. They combine all the natural advantages of warm air heating: quick heat delivery, positive temperature and humidity control, ventilation, and easy adaptability for summer air conditioning. Our engineers will be glad to help you with layouts and specifications on any large warm air heating job. Your inquiry will receive our prompt attention.



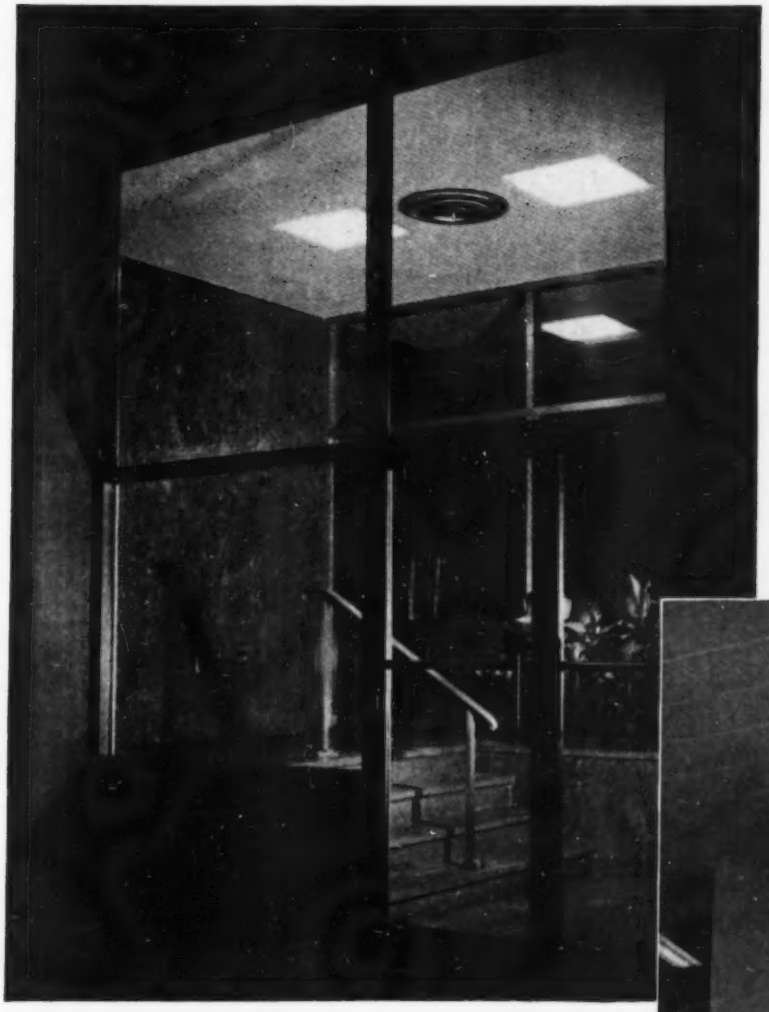
SPECIAL UNITS FOR DRYING & PROCESSING

We build direct oil and gas-fired units up to 14,000,000 BTUs.

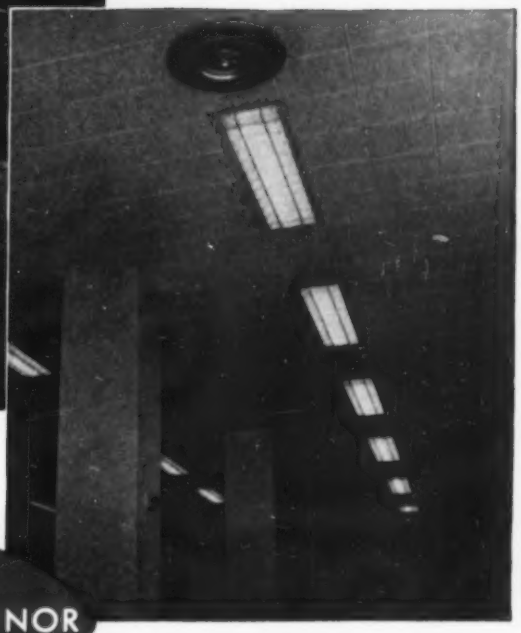
CAMPBELL HEATING COMPANY

Des Moines 17, Iowa

Anheuser-Busch new office building, St. Louis, Mo. • **Architect:** Rathman, Koelle and Carroll, St. Louis, Mo. • **Consulting Engineer:** John D. Falvey, St. Louis, Mo. • **Heating Contractor:** T. J. Sheehan Company, St. Louis, Mo.



the Beauty of it is...



YOU CAN COUNT on handsome Kno-Draft Adjustable Air Diffusers to distribute your conditioned air — warm or cool — in just the right volume and flow pattern to assure the comfort of *uniform temperature without drafts* throughout the conditioned space.

What's more, the fact that Kno-Draft is adjustable *after* installation means less slide rule work for you, and greater flexibility of control to meet both present and future conditions.

You'll find Kno-Draft Adjustable Air Diffusers doing their highly efficient jobs in a large and ever-growing number of America's notable and architecturally significant buildings. You can get them in types and sizes to meet all engineering and architectural requirements.

KNO-DRAFT DATA BOOK. Complete specifications, engineering and installation data on Kno-Draft Adjustable Air Diffusers. Write for your copy, or simply fill in and mail the coupon. No obligation, of course.
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Position.....

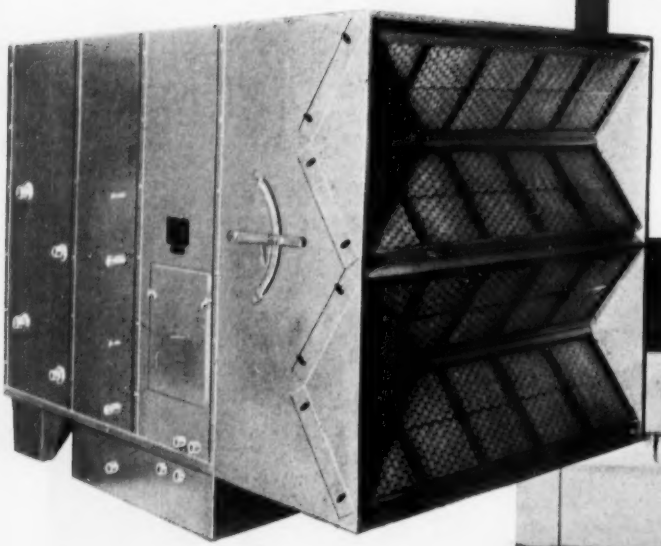
Company.....

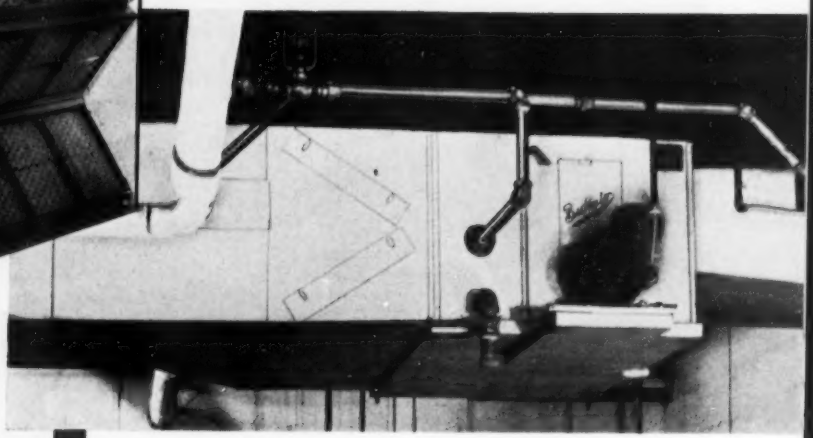
Street.....

City..... **Zone**..... **State**.....

- **easy to install**
- **easy to live with**

"Buffalo"

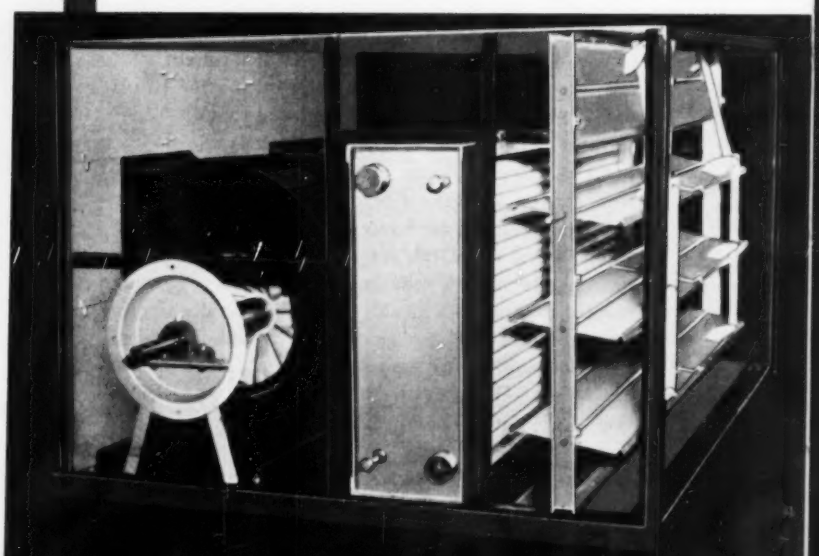




Above, "PCLW" Unit for comfort cooling and industrial applications.

Upper right, flat suspended "PC" Cabinet takes no floor space.

Right, horizontal "PC" Cabinet showing fan, coil and damper sections. Note interior insulation.



DIAMOND JUBILEE 75TH ANNIVERSARY

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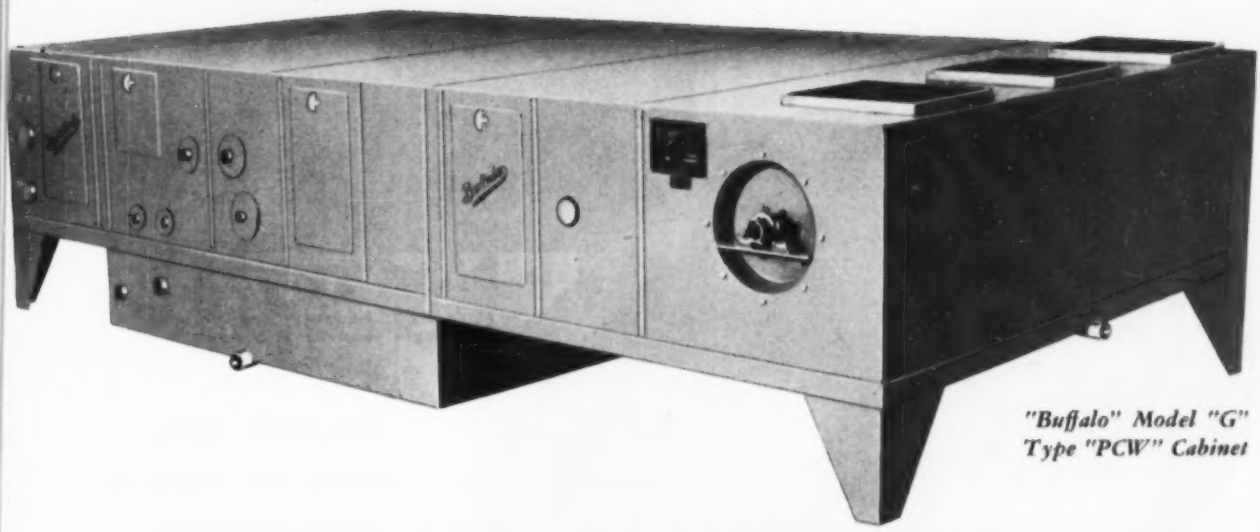


"Buffalo" Model "G"
Type "PCW" Cabinet

"PC" CONDITIONING CABINETS

When you air condition, you want three things — as inexpensive a job as will do, equipment that installs economically — and most important — equipment that gives satisfaction over a long period.

Cost-wise, the central cabinet is the least expensive part of your system; considering compressor, duct-work and building modifications.

Satisfaction-wise, it's the most important!

If the fans are over rated, or inefficient, you'll suffer. If the coils are inefficient or untrustworthy, you'll have poor conditioning.

Why not be sure that on this lowest-cost part of your system, you get the best?

"Buffalo" "PC" Air Conditioning Cabinets, to heat, cool, humidify or dehumidify, or any combination of these functions, have been in use for more than twenty years. They are sectionalized, to pass thru standard building openings, and assemble easily on location. They have husky, quiet, mixed flow fans mounted on large, vibrationless hollow shafts. They have Aerofin coils, by far the best obtainable. They have sturdy, outside - the - housing bearings, for convenient lubrication even after cabinet insulation. In short they are built according to the "Q" Factor* which makes them your best buy!

"Buffalo" Engineering Sales Representatives in principal cities are anxious to serve you. Let them give you full details — no obligation.

** — The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

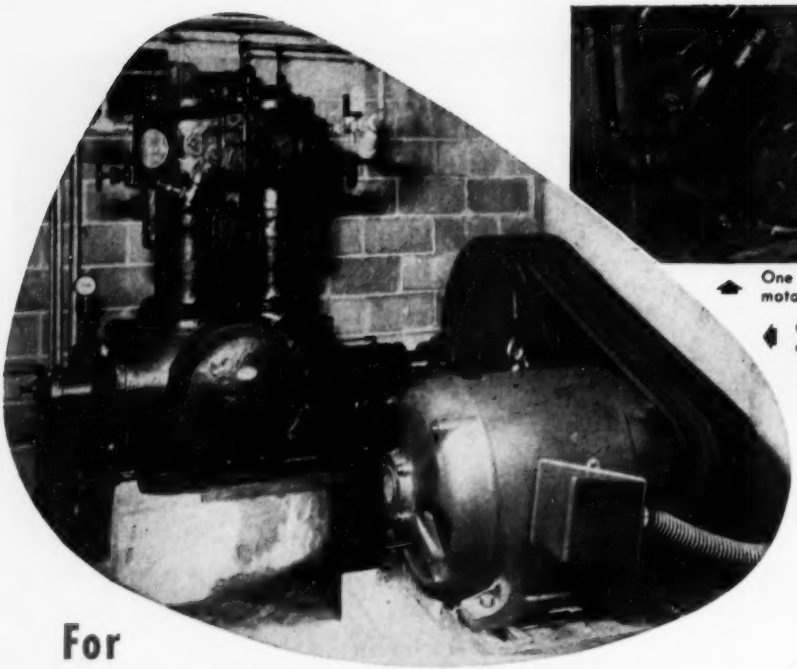
BUFFALO FORGE COMPANY

171 Mortimer Street — Buffalo, New York

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ontario — Sales Representatives in All Principal Cities

HEATING • FORCED DRAFT • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT



One 10 horsepower and a 25 horsepower Century motor furnish power to air condition an office.

Century 75 horsepower Type SCH motor driving a compressor in a skating rink.

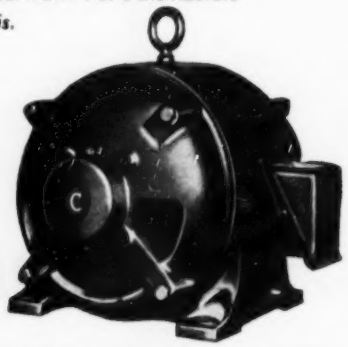
Unusually Quiet Starting and Running Characteristics

For REFRIGERATION COMPRESSORS

You Need the High Starting Torque of..... Century

Century Service Is Near Any Century Motor Driven Equipment. Prompt Service is offered by CENTURY'S National Network of more than 200 Authorized Service Stations, supervised by 28 Century Sales offices.

1. *Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.*
2. *CENTURY Authorized Service Stations are qualified and equipped to service and repair any piece of CENTURY apparatus.*
3. *Genuine CENTURY renewal parts are available at CENTURY Service Stations, CENTURY Parts Distributors and at the factory in St. Louis.*



Type SCH Motors

Century Type SCH, Squirrel Cage polyphase alternating current High Torque motors are ideal for refrigeration compressor applications. They bring compressors up to speed smoothly and easily under full load.

Century Type SCH motors have the high starting torque characteristics required for Refrigeration Compressors. The low starting current is desirable for automatic across the line starting.

In addition, Century builds a complete line of electric motors in a wide range of types, in sizes from 1/8 to 400 horsepower. Specify Century motors for all your electric power requirements.

Century C MOTORS

CENTURY ELECTRIC COMPANY • 1806 Pine Street, St. Louis 3, Missouri

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CE791

how to move air without FAN-FARE

use

ULTRALITE

DUCT INSULATION and DUCT LINER

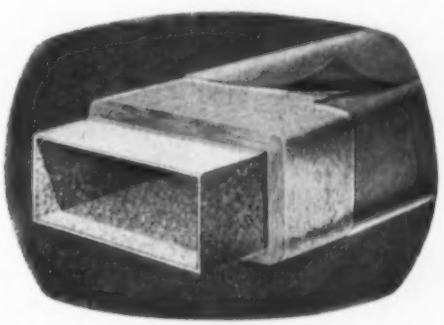
ULTRALITE Duct Liner reduces fan chatter to a w-h-i-s-p-e-r — and it's so easy to install! The long glass fiber captures and absorbs fan noise, lets heating and air conditioning systems run at peak efficiency without disturbing anyone.

And ULTRALITE Duct Liner is easier and more economical to install than any liner you've ever used! You can cut it with a knife . . . run it quickly around curves and corners . . . fasten it securely in place with cement or screws and washers.

For the same good reasons, you'll want to use ULTRALITE Duct Insulation. It goes on faster, cheaper, and does a better job of keeping heat and cold where they belong. You have a choice of *4 attractive vapor barrier facings*, one of which is tailor-made for your particular condensation problem.

ULTRALITE—the duct liner that won't burn!

Ultralite Duct Liner is a flexible, semi-rigid glass fiber insulation designed specifically as an acoustical duct liner, with excellent sound-absorbing properties. It won't break, chip or delaminate—won't flake off in air stream! You can run it quickly around curves and corners, run it through the brakes and shears with the metal, fasten it in place with screws and washers or adhesives.



ULTRALITE—the easy-to-install duct insulation!

It's "duct soup" to wrap air ducts with Ultralite Thermal Duct Insulation—it's as easy as wrapping a package! Ultralite Duct Insulation is available plain or with your choice of 4 different vapor barrier facings, already adhered to the insulation. Ultralite is non-irritating, pleasant to handle, fire-resistant and non-corrosive to metals. K-factor is very low—and so are applied costs!

See Sweet's File (Architectural) or the Yellow Pages for name and address of your local Ultralite distributor.

GUSTIN-BACON MANUFACTURING CO.

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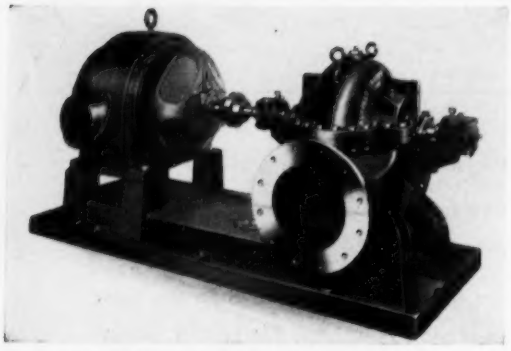
New York • Chicago • Philadelphia • San Francisco • Los Angeles • Houston • Tulsa • Fort Worth • Detroit

"Buffalo" Tips on Better Pumping

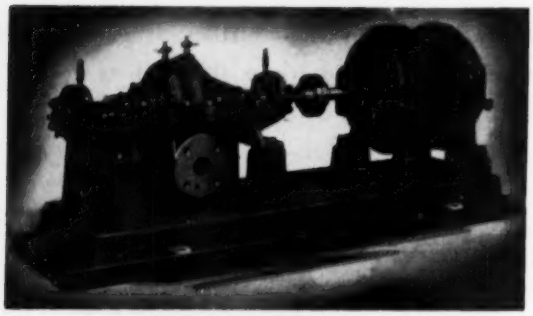
ADVANTAGES of 3 TYPES of CENTRIFUGAL PUMPS



"Buffalo" Type "SL" Double Suction Pump

DOUBLE SUCTION — EFFICIENT IN MOVING HIGH VOLUMES — IMPELLER SUPPORTED FROM 2 SIDES

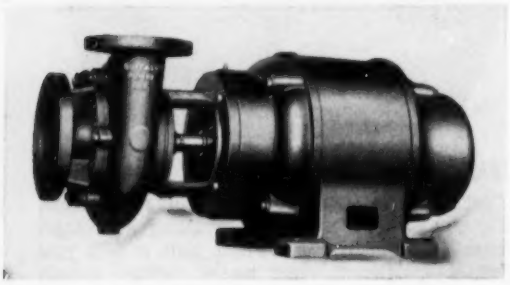
Taking in clear water from both sides of its enclosed double suction impeller, this "Buffalo" Type "SL" Pump is ideally suited to handling large volumes efficiently. Correctly formed water passages and perfect hydraulic balance add to its efficiency. Bearings on both ends of oversize impeller shaft assure maximum life. Large capacity range, from 10 to 10,000 gpm, for air washers, chilled water, humidifier, general service. Write for Bulletin 955-P.



"Buffalo" Type "RR" Two-Stage Pump

MULTISTAGE — EFFICIENT DESIGN FOR HIGH PRESSURES

"Buffalo" builds these durable, easy-to-maintain pumps in two and four stages for heads up to 1500′. Each additional stage develops additional pressure, a highly desirable feature for jobs such as boiler feed. Impeller receives ideal support from bearings on both sides. Horizontally split shell provides quick accessibility. For further details, write for Bulletin 980.



"Buffalo" Type "CCL" Pump

CLOSE COUPLED — SPACE SAVING — PERMANENT SHAFT ALIGNMENT

Available in all iron or special alloys, these husky single suction pumps are built as a unit — require no alignment during installation or afterwards. Each design — single suction, double suction, multistage — offers particular advantages. "Buffalo" builds all types, to give you the best possible pump for your job. Write for details on the full line.

"Buffalo" PUMPS, INC.

171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

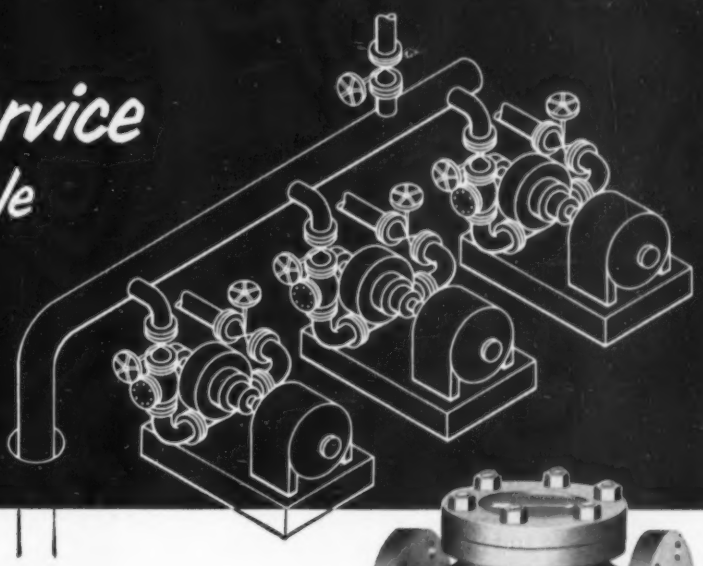
Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

It's not what you Pay for Valves ...it's what they Cost you

on Water Service for example

(A Case History)



Crane Check Valves are made in all types, in brass, iron, steel, and alloys. See your Crane Catalog.

What you pay for valves is not the final criterion of value. Not when maintenance costs can quickly equal or exceed purchase price. And a valve that threatens production is no bargain at any price . . . no attraction to a thrifty buyer.

Take this case in a large eastern paper mill. A single bank of water pumps supplied the entire mill. Leaky check valves at these pumps were a constant problem. Regularly, the checks needed replacement, only to be found leaking between pumping cycles a few months later.

A change-over to Crane Quality Check Valves put a complete stop to this costly maintenance and threat to production. Installed well over a year, Crane checks are protecting the mill against loss of water pressure at no added cost.

Today, more than ever, you need greater assurance of quality in piping materials. You get it in Crane Valves—the recognized standard of quality with thrifty buyers in every industry. Your big Crane Catalog offers complete selections for all needs; your Crane Representative is always at your service.

CRANE VALVES

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas.

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

This valve is packed with 70 years' experience

Oh, I see

OIC's "7200 Line", the bronze valve that 70 years' experience built, incorporates the most advanced engineering, superior workmanship and the finest materials . . . its union bonnet, copper-nickel wedge and long-wearing OIC Alloy 40 stem, for example. You see the difference in the dependability, economy and long, maintenance-free life which OIC Bronze Valves give you.

THE OHIO INJECTOR COMPANY
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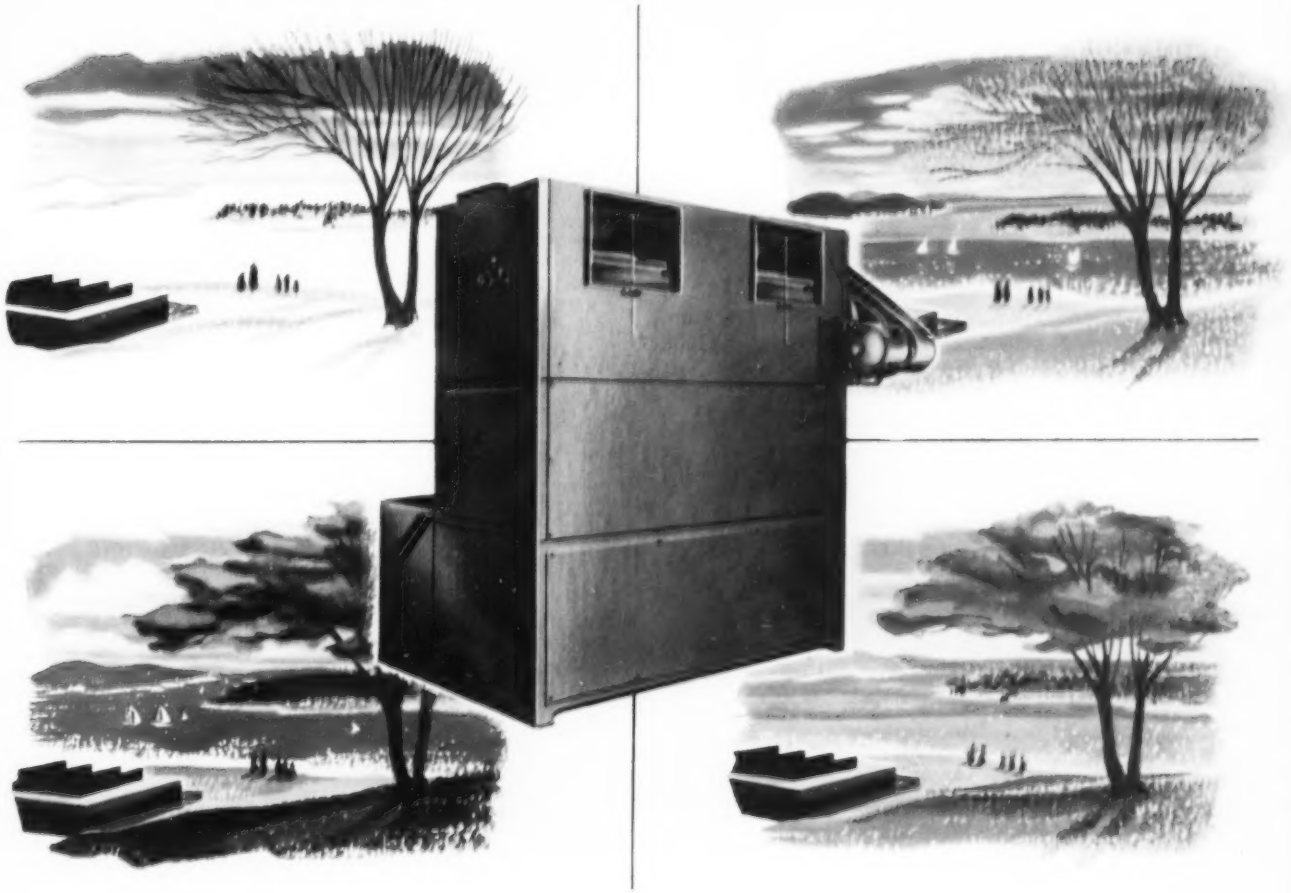
OIC
FOUNDED 1881

VALVES . . . FORGED & CAST STEEL, IRON & BRONZE

American Blower – a time-honored name in air handling



American Blower Air Conditioning units are designed for summer cooling and dehumidifying and winter heating and humidifying.

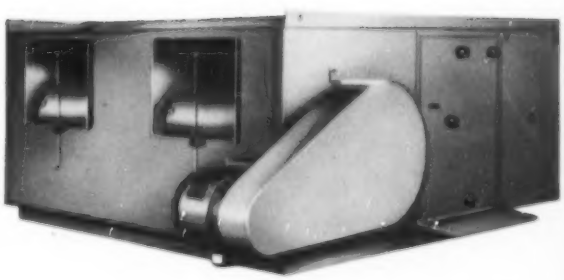
This dual function by the same piece of equipment results in substantial savings in cost and offers much in comfort.

Three types are available: the Type A Conditioner for normal unitary type applications, the Type S Conditioner for unitary type application where washed air or high relative humidities are required, the Type M Conditioner for central system installation.

For data, consult the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation



American Blower Type A Conditioner. Capacities from 1000 to 13,600 cfm. Either direct expanded refrigerants, chilled water, well water or brine can be used for cooling and steam or hot water for heating.

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER

For projects where nothing but the BEST is desired.....
where nothing less than the BEST is acceptable....

Grant Wilson
DUX-SULATION
(ASBESTOS PROTECTED)

Maximum, over-all efficiency in both thermal and accoustical insulation. Engineered exclusively for duct application.

"Costs more, and worth it!"

WRITE FOR DUX-SULATION SAMPLE KIT No. 367-H3

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ASBESTOS and INSULATING MATERIALS
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POWELL VALVES
actually require
less maintenance
Fig. 1793
125-pound Iron Body
Bronze Mounted Gate
Valve for oil, water, gas
and low pressure steam
services. Sizes 2"
to 30", incl.
First, because they are specifically adapted to the service conditions under which they must operate.
Second, because they are engineered—in design, materials, and workmanship—to stand up under those service conditions.
And the proof lies in the actual records of the thousands of Powell Valves that are serving all branches of industry.
The Wm. Powell Company
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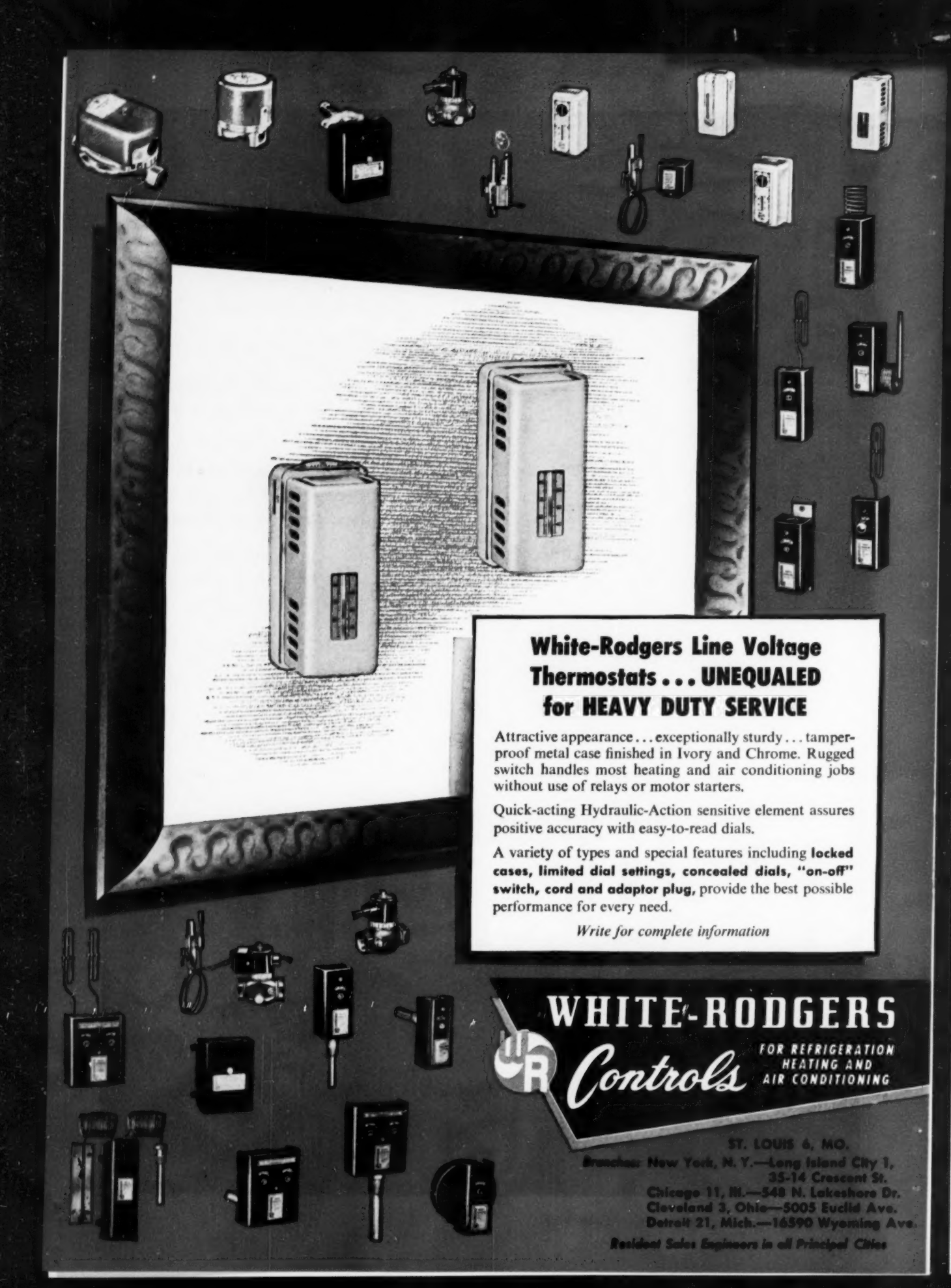
DEPENDABLE VALVES
SINCE 1846
POWELL
BRONZE, IRON, STEEL AND CORROSION RESISTING VALVES



White-Rodgers Line Voltage Thermostats . . . UNEQUALED for HEAVY DUTY SERVICE

Attractive appearance . . . exceptionally sturdy . . . tamper-proof metal case finished in Ivory and Chrome. Rugged switch handles most heating and air conditioning jobs without use of relays or motor starters.

Quick-acting Hydraulic-Action sensitive element assures positive accuracy with easy-to-read dials.

A variety of types and special features including **locked cases, limited dial settings, concealed dials, "on-off" switch, cord and adaptor plug,** provide the best possible performance for every need.

Write for complete information

WHITE-RODGERS

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FOR REFRIGERATION HEATING AND AIR CONDITIONING

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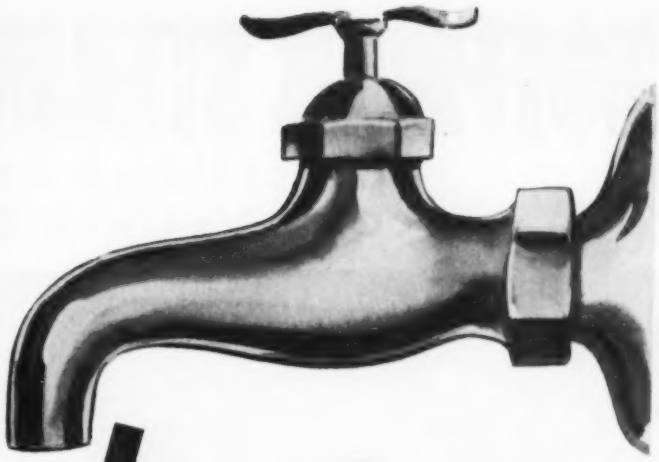
Resident Sales Engineers in all Principal Cities

stop costly profit



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by handling FEDDERS quality line

Call-backs are costly. Sell the idea of an adequate, modern heating system that eliminates squawks.

There is nothing worse than a cold customer. Fedders radiation is designed to perform. You can depend on Fedders accurate catalog ratings.

Compact size . . . light weight . . . easy to stock, deliver and install. Performance record backed by over 57 years of heat transfer experience.

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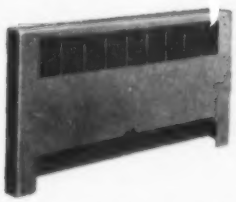
57 TONAWANDA STREET
BUFFALO 7, NEW YORK

UNIT HEATERS



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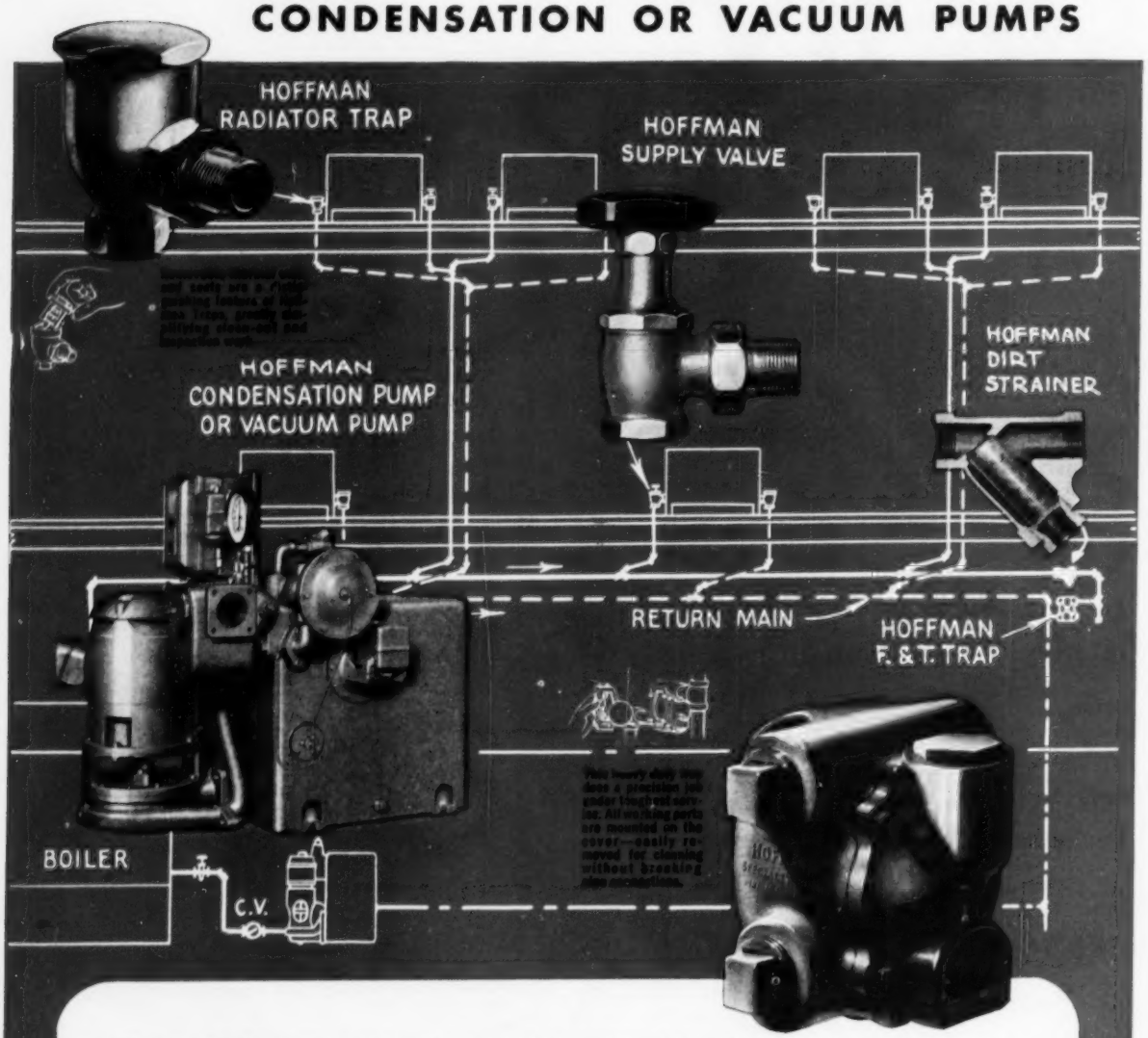
HOFFMAN STEAM SPECIALTIES

FOR SYSTEMS REQUIRING TRAPS, CONDENSATION OR VACUUM PUMPS



There's a Hoffman Trap, Valve, Pump or other specialty designed to give *better control* of every steam system requirement. And, *each* Hoffman product is distinguished by exclusive features that assure customer satisfaction, long, care-free service. *It's the* COMPLETE, *tested, quality line* backed by a dependable, single source of supply and responsibility. *Yet Hoffman Products cost no more than the ordinary kind.* To avoid delays—order now from your wholesaler of heating and plumbing supplies. Catalogs available on all items.

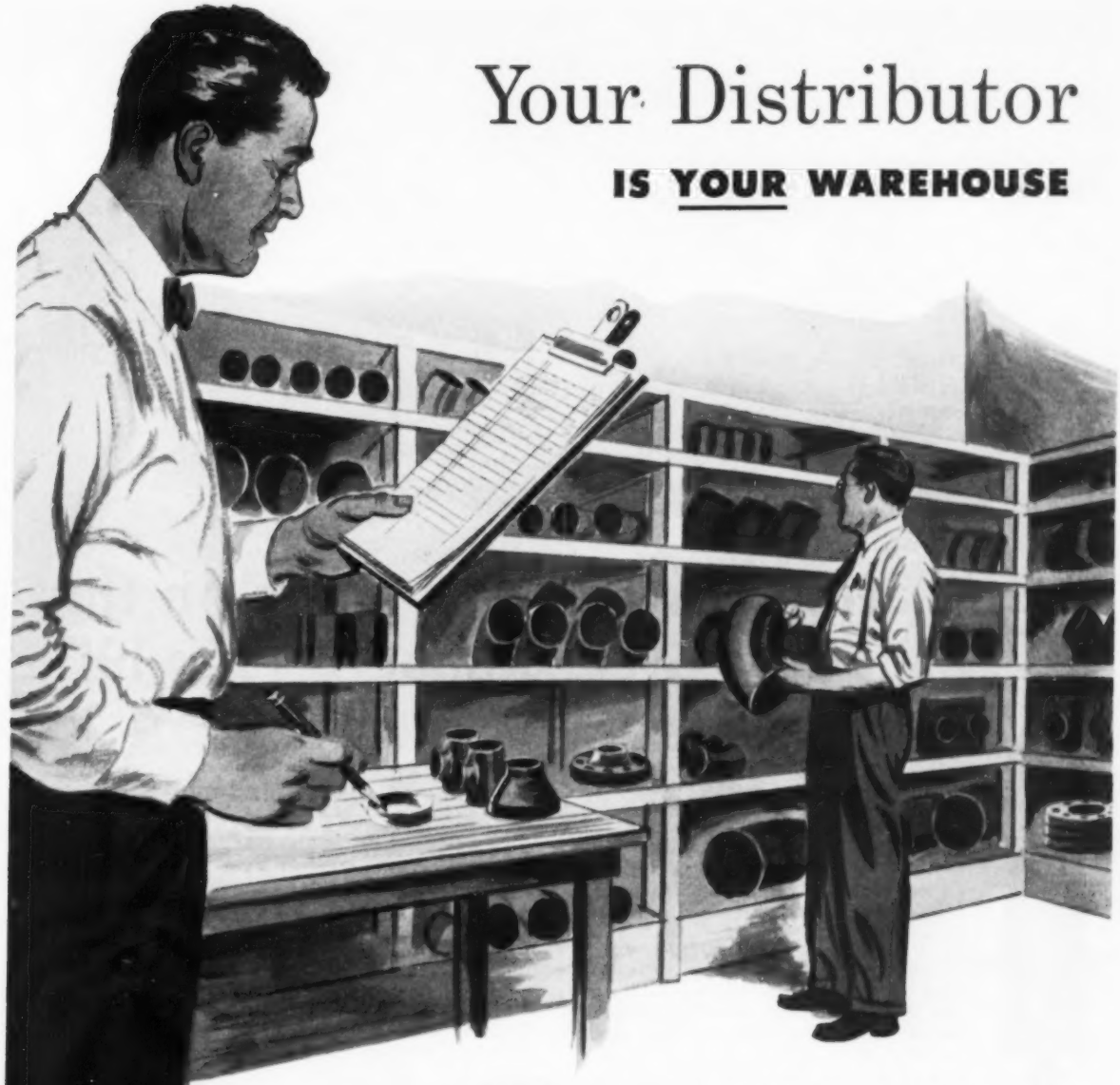
HOFFMAN STEAM SPECIALTIES

HOFFMAN SPECIALTY MFG. CORP., Dept. FG-3
VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING

1001 York St., Indianapolis 7, Ind.
SYSTEMS Sold by leading Wholesalers of Heating and Plumbing Equipment

Your Distributor

IS YOUR WAREHOUSE



ONE of your TUBE TURNS' Distributor's prime functions is to maintain local stocks of equipment and supplies. In effect, he acts as your warehouse—permitting you to operate with reduced inventories, and to move quickly to meet changing production needs.

TUBE TURNS' Distributors and TUBE TURNS, INC., are a service-minded team. Call your nearby TUBE TURNS' Distributors for good service in good connections—it will help you with your inventory and supply operations.

tt TUBE-TURN

"tt" and "TUBE-TURN" Reg. U.S. Pat. Off.

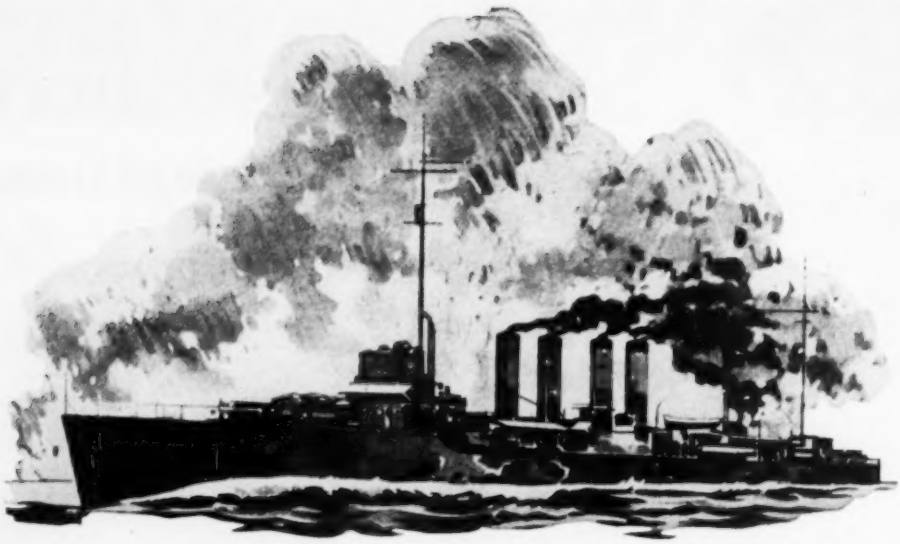
The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles

Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO

PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA. • KEROTEST MANUFACTURING COMPANY, PITTSBURGH, PA.



Ventilating History was made on the destroyer "Kimberley" in 1917

TYPE M VENTILATOR
At End of Cowl Trunk

When the destroyer "Kimberley" (one of World War I's gallant four-stackers) was built at Boston Navy Yard in 1917, an installation of four Wing-Scruplex Ship Ventilators was made in four of her ventilating cowls.

This marked a milestone in ventilating history, proving the value of propeller fans in marine ventilation, and marking also the use of propeller fans—later known as axial flow fans—by the U. S. Navy.

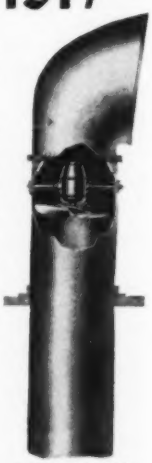
Cowls, dependent upon ship motion or wind velocity to "scoop" air in or lead it out, were of little or no value when a ship was at anchor, or running in a following wind. Powerful Wing (Scruplex) propeller fans, installed directly in the cowl trunks, gave positive ventilation at all times.

The special feature of Wing (Scruplex) propeller fans was their ability to deliver air at high velocities and static pressures.

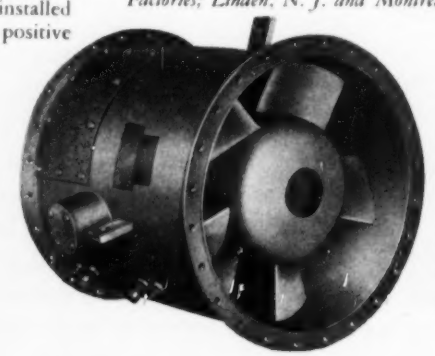
Hundreds of ships, Naval and Commercial, have since been similarly equipped.

Today, with the development of still more powerful propeller fans, as the Wingfoil Axial-Flow Fan, following the same "fan in trunk" idea, the use of extensive air distributing duct systems made it possible to bring positive ventilation to remote parts of the ship.

L. J. Wing Mfg. Co., Linden, N. J.
140 Vreeland Mills Road
Factories; Linden, N. J. and Montreal, Canada

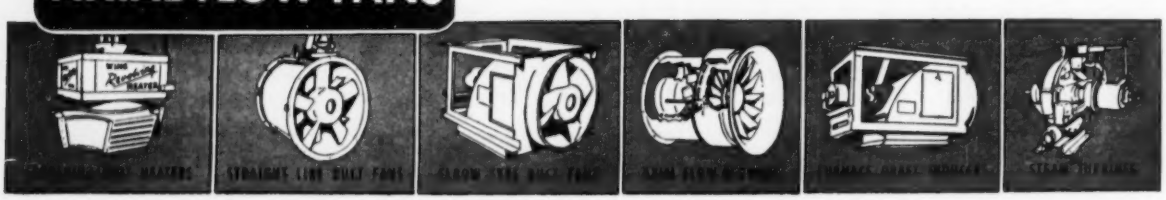


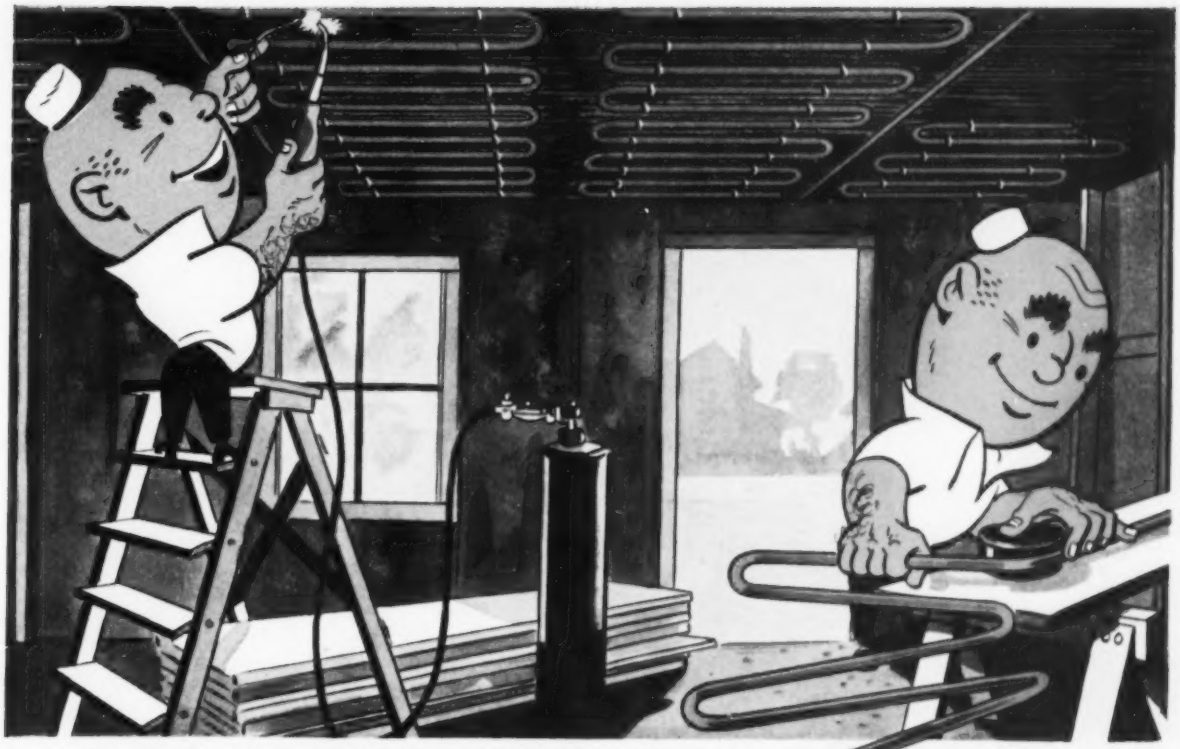
TYPE T VENTILATOR
At Top of Cowl Trunk



Write for detailed information on Wingfoil Axial Flow Fans and Wing-Scruplex Ship Ventilators

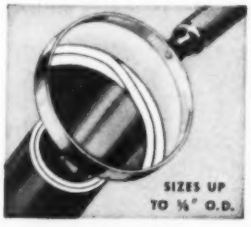
Wing
AXIAL FLOW FANS





Rugged, lightweight Bundyweld Tubing can be formed by one man, mounted by two. Joining is swift and sure. Coils lie flat and straight, are plastered over quickly. Tough steel resists accidental damage.

Show your heels to competition . . . with Bundyweld Ceiling Radiant Heating



Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, thinner walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20′ lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

Here's your chance to grab the lead, leave competition 'way behind for years to come.

Take on Bundyweld Ceiling Radiant Heating, the *new* system with all these sales points: Heat is even, for comfort *anywhere;* it's amazingly clean, trouble-free; yet it actually costs *less* to run. Day by day it's making other heating methods more obsolete.

And buyers are learning about it, too. People by the millions are reading Bundy ads in *Better Homes and Gardens, American Home,* and *House Beautiful.* They're swamping Bundy with requests for literature. And from every part of the country, people are writing for the names of plumbing and heating contractors who handle Bundyweld Ceiling Radiant Heating *in their localities.*

The bandwagon is coming, but you can be 'way out in front of it. Send for your free literature now.

Radiant Heating Division
BUNDY TUBING COMPANY
Detroit 14, Michigan

SEND FOR FREE LITERATURE!

LIKE HAVING THE SUN IN YOUR CEILING

Bundyweld Ceiling Radiant Heating

Radiant Heating Division, Dept. HP353
Bundy Tubing Company, Detroit 14, Mich.

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.
☐ Send Bundy technical radiant heating pamphlet.

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

PUTTING *Air* TO WORK FOR EASTERN INDUSTRIES

Machined surfaces flat to one light band—that's one-millionth of an inch—are made possible the year 'round by Westinghouse air conditioning.

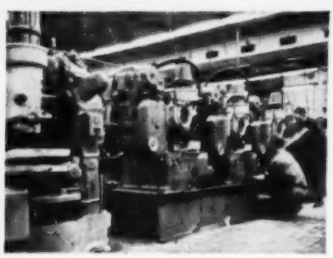
CONDITIONED AIR

HELPS WIPE A WINDSHIELD AT 30,000 FEET

This midget motor-pump sprays a grease-removing solvent onto aircraft windshields. Another provides ground-level conditions for air-borne radar in the stratosphere. Eastern Industries *mass produces* both, but with *tool-room precision*. Critical dimensions are held to plus or minus 25 millionths of an inch! That just isn't possible in hot, humid air.

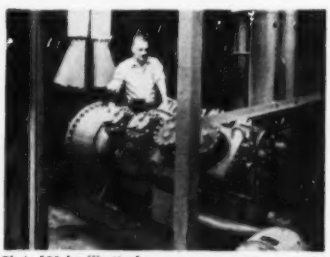
The answer? Westinghouse-conditioned air maintains plant-wide, controlled atmosphere for such exacting machining, assembling, testing and inspecting. Air conditioning and air cleaning assure a constant temperature and humidity the year 'round, help guard against the dirt, rust and corrosion that will upset delicate gauges or mar super-finished surfaces.

Your product, processes and employees will do better in Westinghouse engineered air. Let us help you *put air to work* for more production, higher quality or improved methods. Check the Yellow Pages for your local Westinghouse Air Conditioning Distributor, or write Westinghouse Electric Corp., Air Conditioning Division, Hyde Park, Boston 36, Massachusetts.



Ducts supply entire building with conditioned air for precision work like this gear cutting operation.

This electronic gauge is so sensitive that even your body heat can cause deflections in its readings.



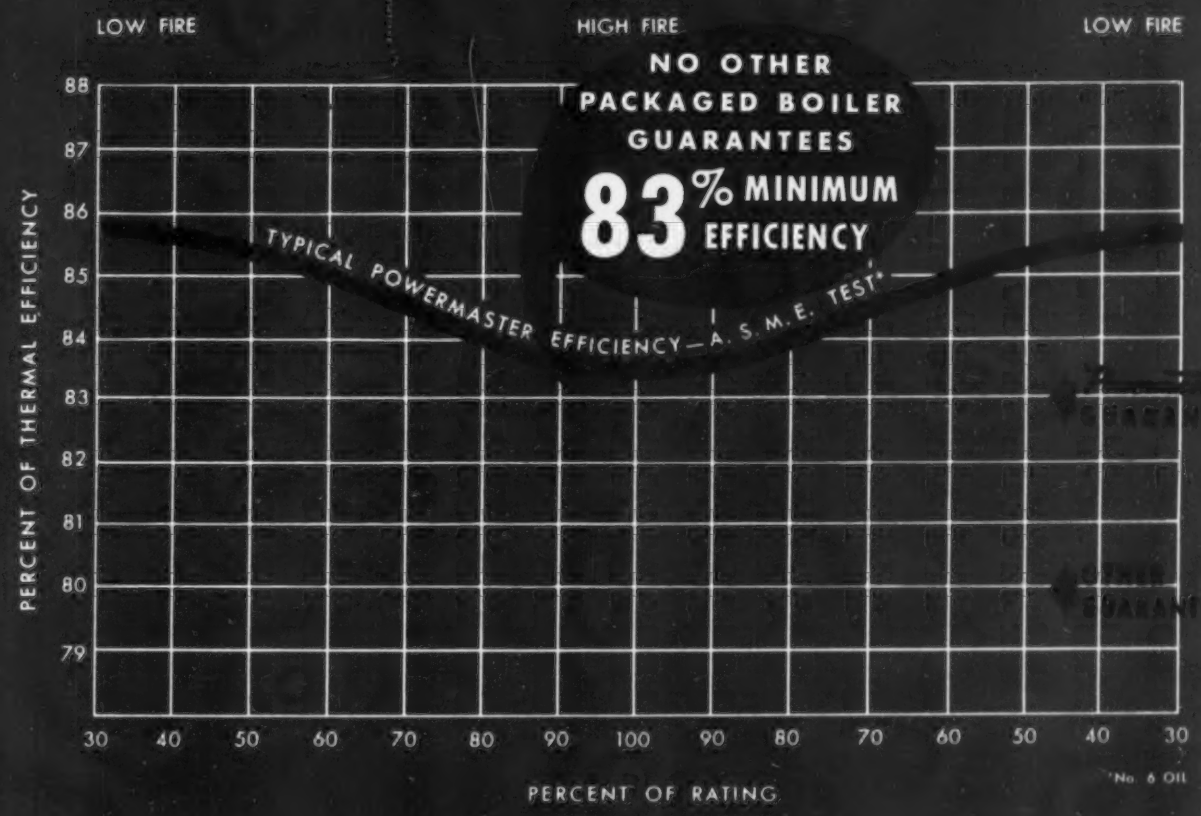
Their 100 hp Westinghouse compressor is as foolproof as your refrigerator, will give years of service.

YOU CAN BE SURE...IF IT'S

Westinghouse

AIR CONDITIONING

J-80248



Only Powermaster guarantees 83%!

The "pay-off" on a boiler is its operating efficiency!

Take a look at this typical efficiency curve of POWERMASTER . . . then compare A.S.M.E. tests with those of any other boiler! At less than full load (which is normal in field operation) notice that POWERMASTER efficiency actually *increases.*

There's a reason for such efficiency. The POWERMASTER is the development of 68 years' experience in boiler manufacture. Continuing research and progressive engineering have consistently been reflected in POWERMASTER design:

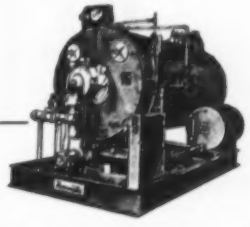
- **FIRST to provide the Voriflow air-atomizing burner.**
- **FIRST to provide full modulating cam control.**
- **FIRST to provide immediate change-over from oil to gas firing.**
- **FIRST to provide a *complete* packaged unit.**

Point-by-point, POWERMASTER welcomes comparison. Before deciding on a new boiler for your plant, be sure to get the facts on the new POWERMASTER with VORIFLOW combustion. Just drop us a line and we'll be glad to send you complete information.

Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.

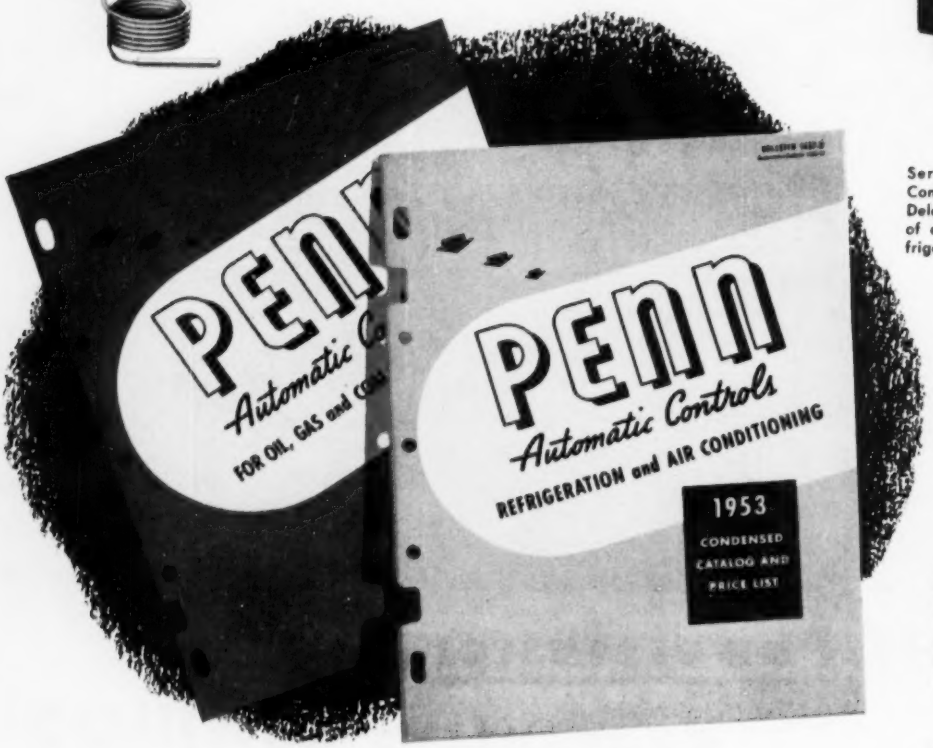


ORR & SEMBOWER, INC. • *Established 1885* • 990 MORGANTOWN ROAD, READING, PENNA.

Penn Series 270 temperature and pressure controls incorporate 2-pole construction and a direct-reading calibrated scale which shows both cut-in and cut-out points.

Penn Unit Heater Thermostat features "heat anticipation" and a built-in "on-off" switch. Cooling Thermostats and Humidistats are also available in the Penn line.

Series 275 Oil Protection Control with built-in Time Delay Switch for protection of all pressure-lubricated refrigeration compressors.



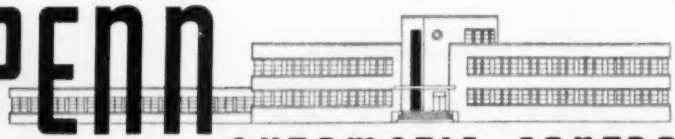
Penn Magnetic Starters are built in NEMA sizes 0, 1 and 1½ and are available as open-type models for control panels or with General Purpose enclosures.

to make control selection easier... USE THESE *FREE* NEW CATALOGS

They're yours for the asking . . . and they'll save you time and effort in selecting the exact control you want for air conditioning, refrigeration and space heating jobs. Each of these condensed catalogs contains complete description, specifications and prices. Write for your FREE copy now. **Penn Controls, Inc., Goshen, Ind.** Export Division: 13 E. 40th Street, New York 16, N. Y., U.S.A. In Canada: Penn Controls Limited, Toronto, Ontario.

Series 246 Water Valves are built in threaded and flanged styles for all refrigerants and in sizes from ⅜" to 2½".

PENN

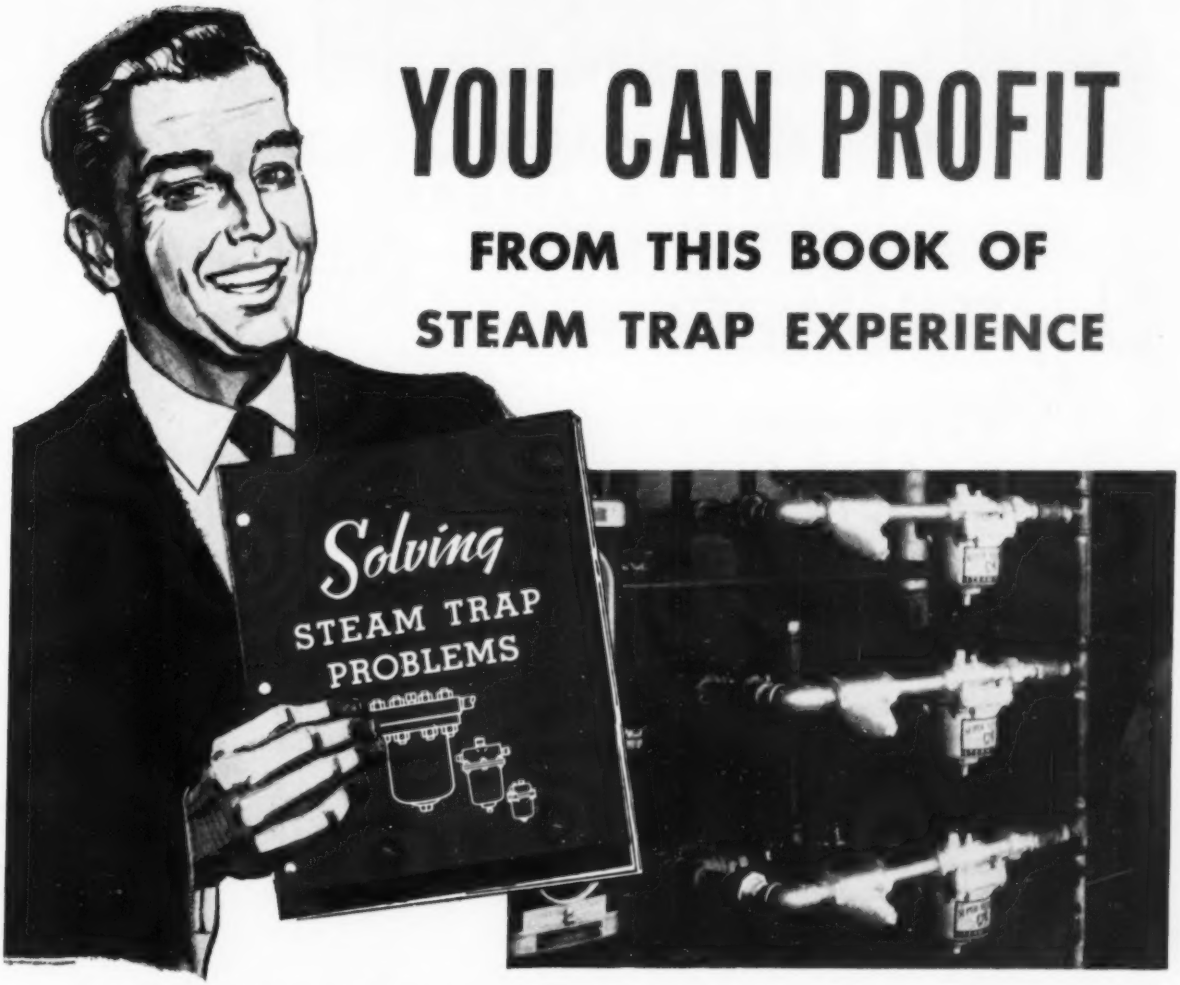


AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

YOU CAN PROFIT

FROM THIS BOOK OF STEAM TRAP EXPERIENCE



● The tough school of experience is a great teacher. Over the years Anderson engineers have gathered an immense quantity of data on how other companies have changed steam trap problems into profits. Many of them are in your own field.

These facts have been condensed into a fast-reading, illustrated book of 36 pages called "Solving Steam Trap Problems". You'll find many suggestions in it on how to cut costs of trapping condensate in your plant. As an example, it shows how you can install a steam trap so that you can easily service the trap without disturbing a single pipe fitting . . . saving up to half an hour every time you inspect the trap, or replace the valve and seat. You'll find many other suggestions on how to select the right steam trap for maximum efficiency on every job.

Anderson invites you to share its long cost-cutting experience. Send the coupon today or write on your letterhead.

Super-Silvertop Steam Traps are right for each job . . . installed faster, serviced quicker than any other trap. Made by the V. D. Anderson Company, manufacturers of Hi-eF Purifiers, Anderson Strainers, Silvertop Air Release Valves and other products of exceptional quality and value.

YOURS FOR THE ASKING!

THE V. D. ANDERSON COMPANY
1949 West 96th Street • Cleveland 2, Ohio

Gentlemen: Please send me a copy of "Solving Steam Trap Problems."

Name ..... Title .....

Address .....

City .....

State .....

In Canada: Bawden Industries, Ltd., Toronto

SUPER-SILVERTOPS

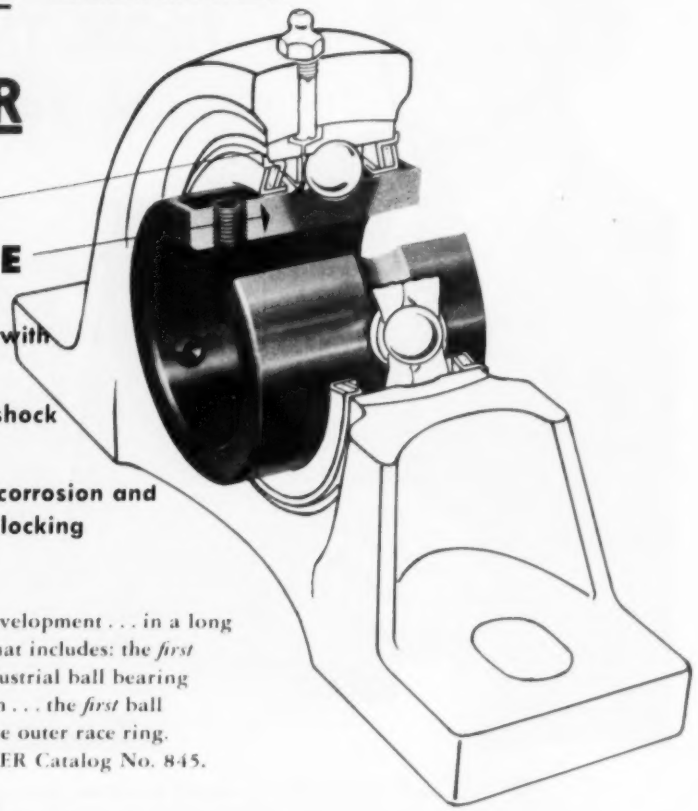
THE ENGINEERED STEAM TRAPS

ZONE HARDENING*

for MAXIMUM LIFE EXPECTANCY in EVERY BEARING!

Only **SEALMASTER**

is **HARD HERE**
but **SOFT HERE**



- to permit race-to-shaft locking with increased holding power
- to insure greater resistance to shock and vibration
- to minimize danger of fretting corrosion and eliminate shaft wear by firmer locking of bearing to shaft

Zone Hardening is another major development . . . in a long history of SEALMASTER advances that includes: the *first* self-aligning, permanently sealed industrial ball bearing unit . . . the *first* outer race locking pin . . . the *first* ball retainer riding the inner surface of the outer race ring.

Write for your copy of SEALMASTER Catalog No. 845.

ZONE HARDENED
PERMANENTLY SEALED
SELF-ALIGNING • PRE-LUBRICATED
FLOATING BALL RETAINER

***ZONE HARDENING**

is a completely automatic heat treating process by which the inner race ring of SEALMASTER Ball Bearing Units is hardened through ball path section *only*. (See cutaway view.) The extended part of the inner race is left in its original metallurgically soft, tough state. Hardened set screws are mounted through this soft portion, to provide firm race-to-shaft locking and the performance advantages mentioned above. ZONE HARDENING is patented—exclusively SEALMASTER'S!

SEALMASTER BEARINGS

A Division of Stephens-Adamson Mfg. Company
47 Ridgeway Avenue, Aurora, Illinois

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

LATEST TESTS add a

3rd Important NEW USE for SPORLAN Catch-All FILTER-DRIERS

on Comfort Cooling and Air Conditioning installations

1. FILTERING INSTEAD OF STRAINING

2. DRYING

3. ACID REMOVAL

Everyone knows...

the tremendous advantages Catch-Alls have over ordinary strainers and driers for perfect filtering and drying. But recent tests prove that in addition Catch-Alls remove the harmful corrosive acids which cause the most serious problems in refrigeration systems today! Acids also attack hermetic motor windings, causing costly burnouts. Guard against these failures by always installing Catch-Alls!

SEALED CATCH-ALL

Here Are The 5 Exclusive Catch-All Filter-Drier Features that will give you really clean, really dry, acid free refrigeration systems

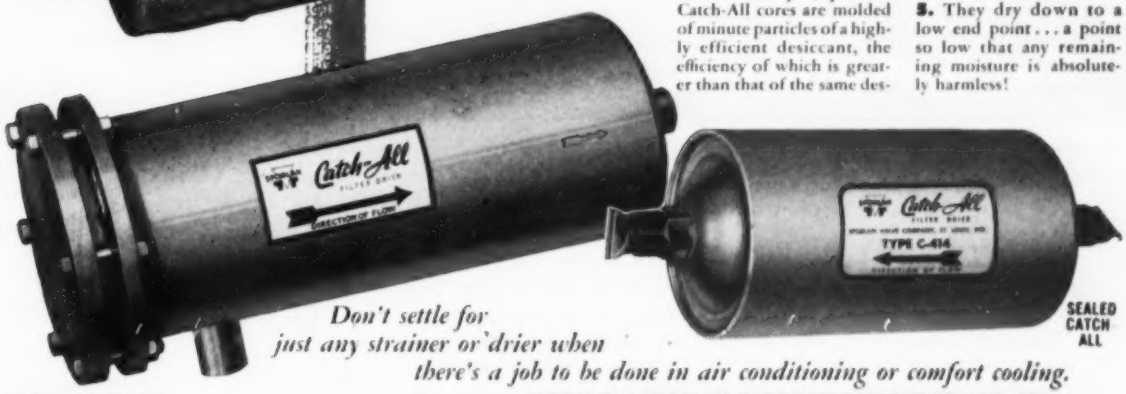
1. They cannot powder!

2. They cannot pack!

3. The refrigerant cannot channel around the desiccant!

4. The unique, porous Catch-All cores are molded of minute particles of a highly efficient desiccant, the efficiency of which is greater than that of the same desiccant in granular form. 100% activation after complete assemby, then sealed with moisture proof seals.

5. They dry down to a low end point... a point so low that any remaining moisture is absolutely harmless!



SEALED CATCH ALL

REPLACEABLE CORE CATCH-ALL

Don't settle for just any strainer or drier when there's a job to be done in air conditioning or comfort cooling.

DEMAND A SPORLAN CATCH-ALL FILTER-DRIER AND GET PEAK PERFORMANCE RIGHT DOWN THE LINE

Send for YOUR NEW CATCH-ALL BULLETINS *Today!*

SPORLAN VALVE COMPANY

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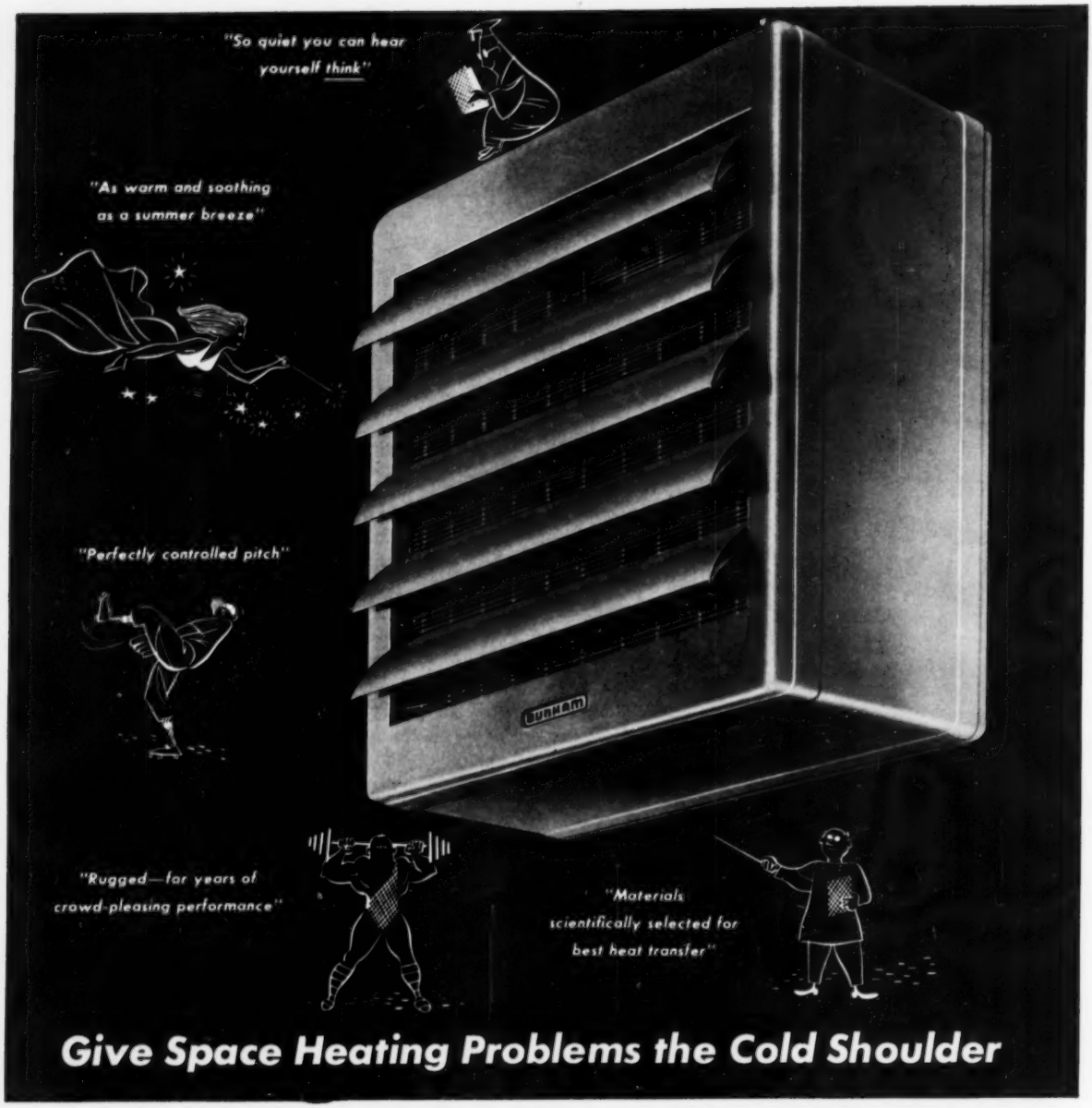
89 BROAD STREET NEW YORK 4, N. Y.


"So quiet you can hear yourself think"
"As warm and soothing as a summer breeze"
"Perfectly controlled pitch"
"Rugged—for years of crowd-pleasing performance"
"Materials scientifically selected for best heat transfer"
DUNHAM

Give Space Heating Problems the Cold Shoulder

You can ignore almost any space heating problem with the proper capacity Dunham Unit Heater on the job. It's a good way to get the exact amount of heat . . . when, where and how you need it.

Dunham Heaters have a "plus value" in quality construction, too—a rugged *cast bronze header* is standard equipment! It's non-corrosive which means extra years of top-notch performance.

Dunham Heaters are as quiet as they are comfortable. Fans turn at relatively slow speeds, driven by rubber mounted motors. Louvers don't loosen, rattle or bang. With Dunham Heaters you hear little; feel just right. Write today for further facts.

Send for Free Bulletin

Bulletin 1301-2 tells how sturdy, longer lasting Dunham Unit Heaters can solve your space heating headaches. Full data on sizes, construction, capacities. Your free copy is waiting now at: C. A. Dunham Company, 400 W. Madison Street, Chicago 6, Illinois.

DUNHAM **UNIT HEATERS** DUNHAM 1903-1953

Quality first for fifty years

ANOTHER QUALITY PRODUCT OF C. A. DUNHAM COMPANY—CHICAGO • TORONTO • LONDON

AND INGERSOLL-RAND MOTORPUMPS FOR AIR CONDITIONING GIVE YOU MORE THAN TROUBLE-FREE SERVICE

Air conditioning contractors who have installed Ingersoll-Rand Motorpumps on thousands of different air-conditioning units tell us these rugged pumps stay on the job with surprisingly little maintenance. You put them in . . . then forget them. They are remarkably easy to install. They operate equally well in any position, with no special foundations needed. Further, whenever these contractors had headaches fitting large pumps into small air conditioning units, they liked the compactness of Ingersoll-Rand Motorpumps.

An outstanding feature of I-R Motorpumps is their amazing efficiency. On the job they have proved to be the leader in their horsepower range.

These Motorpumps are available now for immediate delivery out of warehouse stocks. Your nearest Ingersoll-Rand representative has all the facts and figures you may need. Call him in now, or write us for the new booklet, "A Picture of the I-R Motorpump Line for Air Conditioning", Form No. 7177. INGERSOLL-RAND COMPANY, 11 Broadway, New York 4, N. Y.

Two 5 hp Ingersoll-Rand Motorpumps at work on an evaporative cooler.

MOTORPUMP

. . . designed for

AIR CONDITIONING SERVICE

available now for immediate delivery in a wide range of sizes!

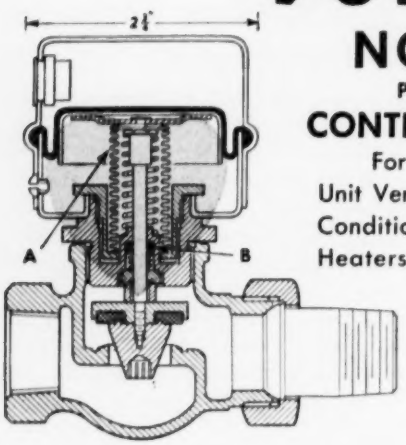
Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

793-9

New! *Look what Powers has done to* ***Modernize*** *Control Valves*

Powers NO-PAK Valves Banish Packing Maintenance
Prevent leakage of water or steam or loss of vacuum



POWERS

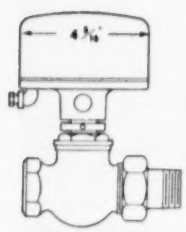
NO-PAK

Pneumatic

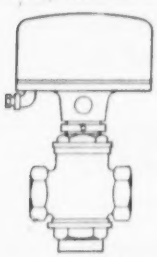
CONTROL VALVES

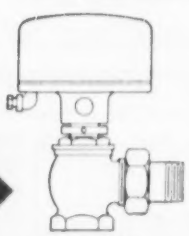
For Convectors, Unit Ventilators, Unit Air Conditioners, Baseboard Heaters, Radiators, etc.

Various Types and Sizes for all requirements



Straightway Union
3-Way Screwed Ends





Angle Union

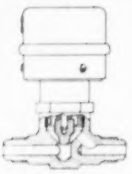
Another POWERS Contribution to Better Heating and Air Conditioning Control

NO-PAK valves with their many advantages are now standard with Powers temperature control systems. Their superior performance is due to Duo-Seal construction.

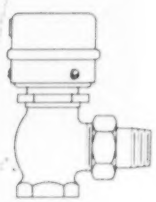
Bronze Packless Bellows (A) in sectional view above, is the primary seal which eliminates packing maintenance — packing friction — steam and water leakage or loss of vacuum. It is designed to withstand pressure up to 150 psi. Maximum valve stroke is only two-thirds of the normal bellows stroke. A spring loaded secondary seal (B) permits servicing of valve top without draining the water system or shutting down the steam heating system. Seal is made of highly elastic neoprene and is ready to act at any time. Small contact between seal and the highly polished stainless steel stem makes friction a negligible factor.

For utmost dependability and lowest cost maintenance specify control by Powers NO-PAK Valves.

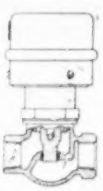
Straightway Union



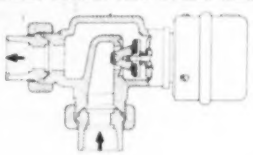
Flared Ends



Angle Union
← Screwed Ends

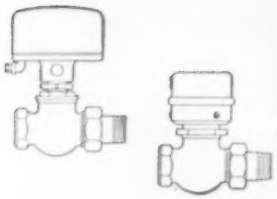


Below: Reverse Flow Double Union



(1b2)

WHEN YOU BUY SPECIFY INSTALL TEMPERATURE CONTROL



Why not get the important advantages of a POWERS System with its MODERN NO-PAK Control Valves?

NO LEAKAGE of STEAM or WATER

Install them and forget them

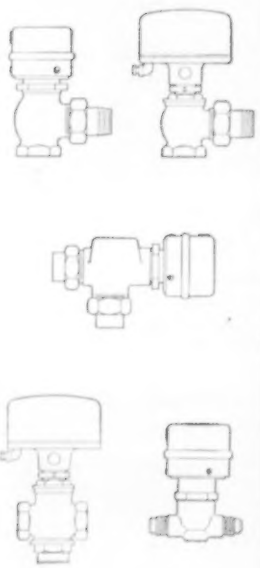
NO LOSS OF VACUUM

leakage of air reduces efficiency of heating system and increases corrosion in return lines

NO PACKING MAINTENANCE

TYPICAL SPECIFICATION for Powers NO-PAK Pneumatic CONTROL VALVES

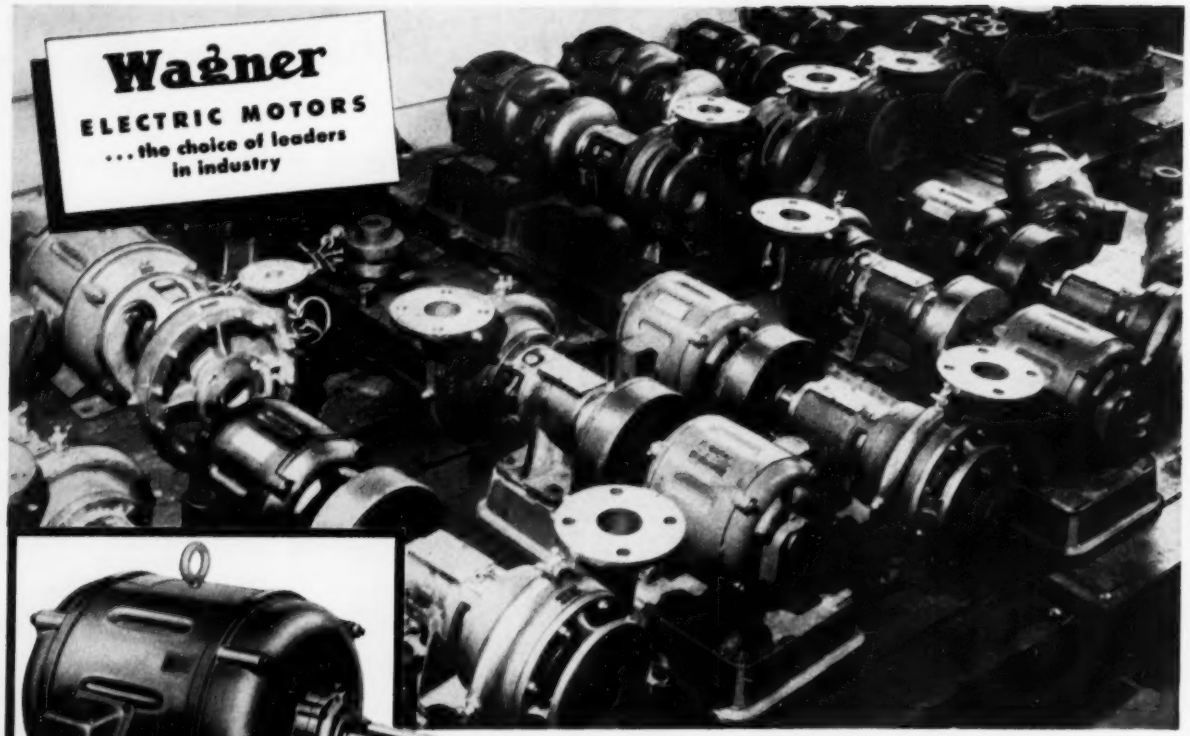
The FIRST and ONLY Control Valve with DUO-SEAL Packless Feature



Control valves for convectors, radiators and unit ventilators shall be packless type with bronze packless bellows to eliminate steam and water leakage or loss of vacuum. This packless bellows shall be located so that it is not subject to corrosive action of the steam or water. A spring-loaded secondary seal shall be provided to permit convenient inspection or servicing of valve top without draining the water system or shutting down the steam supply.

Valve sizes shall be determined by control manufacturer for capacities specified. Type of valve body and type of valve top to be used shall be as required to best satisfy the application. Valves shall be equipped with phosphor bronze bellows or Neoprene diaphragms of sufficient size to close off against specified line pressures. Diaphragms shall be replaceable. Valves shall be equipped with characterized throttling plugs to insure a measured flow of steam or water in direct relationship to the demand of the controlling thermostat. (12a)

POWERS CONTROL



Wagner Motors furnish plenty of power for pumps

Motors that drive pumps and compressors need plenty of electrical and mechanical stamina to hold up under the hard, steady grind expected of them.

Fitting the right motor to your pumps is not a problem of special motor designing and building, but of choosing a standard Wagner Motor suited to the job. Wagner Motors are diversified in design and can be readily adapted to a wide range of pump applications.

Wagner Motors are chosen for thousands of pumps because they can deliver plenty of sure, easy, continuous power. They require very little attention—Wagner Motors are designed to keep maintenance at a minimum. They give the kind of service you want—more than sixty years of motor building experience stands behind every motor bearing the Wagner name.

Improve the performance, economy and dependability of your product by choosing Wagner Motors. Bulletin MU-185 gives information on the complete line. Let a Wagner engineer discuss your motor needs with you. Consult the nearest of our 32 branch offices, or write us.

it's to your advantage to standardize with Wagner:

When you standardize on Wagner Motors—you get the advantages of a liberal warranty ... of nationwide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 750 Authorized Service Stations. You can choose from a wide variety of types and sizes (from 1/125 to 400 hp).

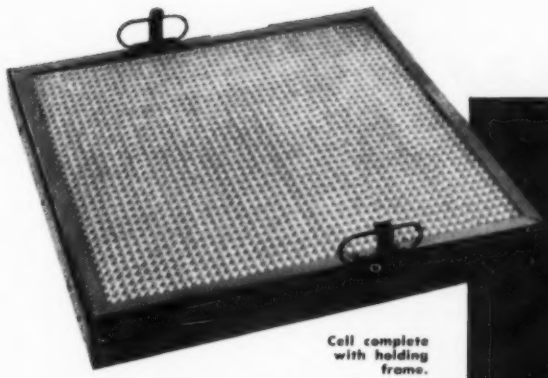
®Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

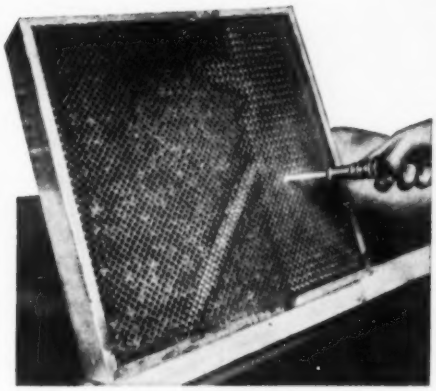
BRANCHES IN 32 PRINCIPAL CITIES

M53-4

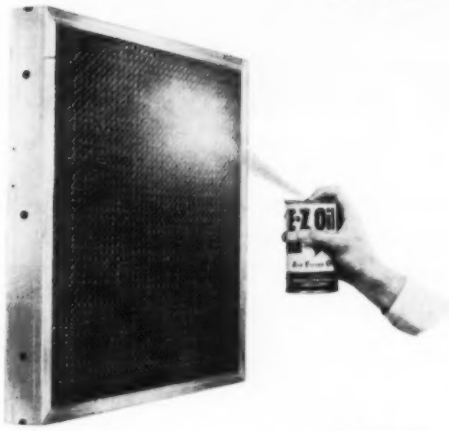


Cell complete with holding frame.

Now... Easier and Faster to Clean and Re-Oil



Unit can be quickly cleaned with cold water from ordinary hose.



Unit can be efficiently re-oiled by using E.Z.Oil Pressure Bomb.

Continental E·Z·Wash Air Filter Units . . . available in all standard sizes . . . now provide extremely high cleaning efficiency, extremely low resistance and extremely simple maintenance.

Since Continental's media affords large, smooth, non-clogging air passageways, it is practical to clean and re-oil these E·Z·Wash permanent-type units rapidly, simply and economically.

Continental E·Z·Wash filters are the only cleanable air filters which require no hot water, detergents or special cleaning tanks. Water under normal line pressure . . . an ordinary garden hose and nozzle . . . are all that are needed.

After cleaning, it is just as easy to re-oil. Simply use Continental's E·Z·Oil Pressure Bomb.

Low maintenance has always been a major advantage in Continental E·Z·Wash filters. Now it is unequalled. Write for further details.

CONTINENTAL

P. O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.

GENTLEMEN: Please send the following:
- ☐ New Bulletin No. 401-A
- ☐ Sample of E·Z·Wash Air Filter Media

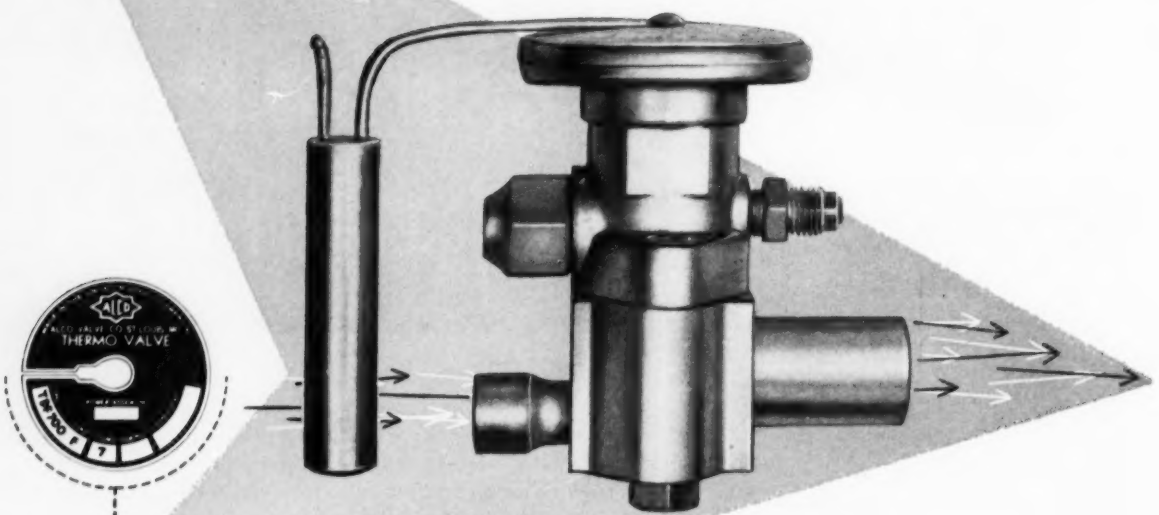
NAME_____

FIRM_____

STREET_____

CITY_____ STATE_____

NEW! for tight spots



ALCO "T" SERIES THERMO VALVES with "STRAIGHT-THROUGH" CONNECTIONS

New description code for all ALCO VALVES: The type number expresses the capacity:

EXAMPLES:
TCL 200 = 2 tons
THL 5000 = 50 tons

This makes it easier for you to select the right valve, to keep stock and to avoid errors.

Easy to install in tight spots. You work from *above* . . . no twisting and turning. "Straight-through" connections fit over any type of distributor. They give you the same easy, on-the-line servicing features as Alco "T" Valve with angle-type connections.

When ordering, please specify whether "angle-type" or "straight-through" connections are desired. For "Freon-12", "Freon-22", Methyl Chloride. Write for further information.

SEE YOUR ALCO WHOLESALER

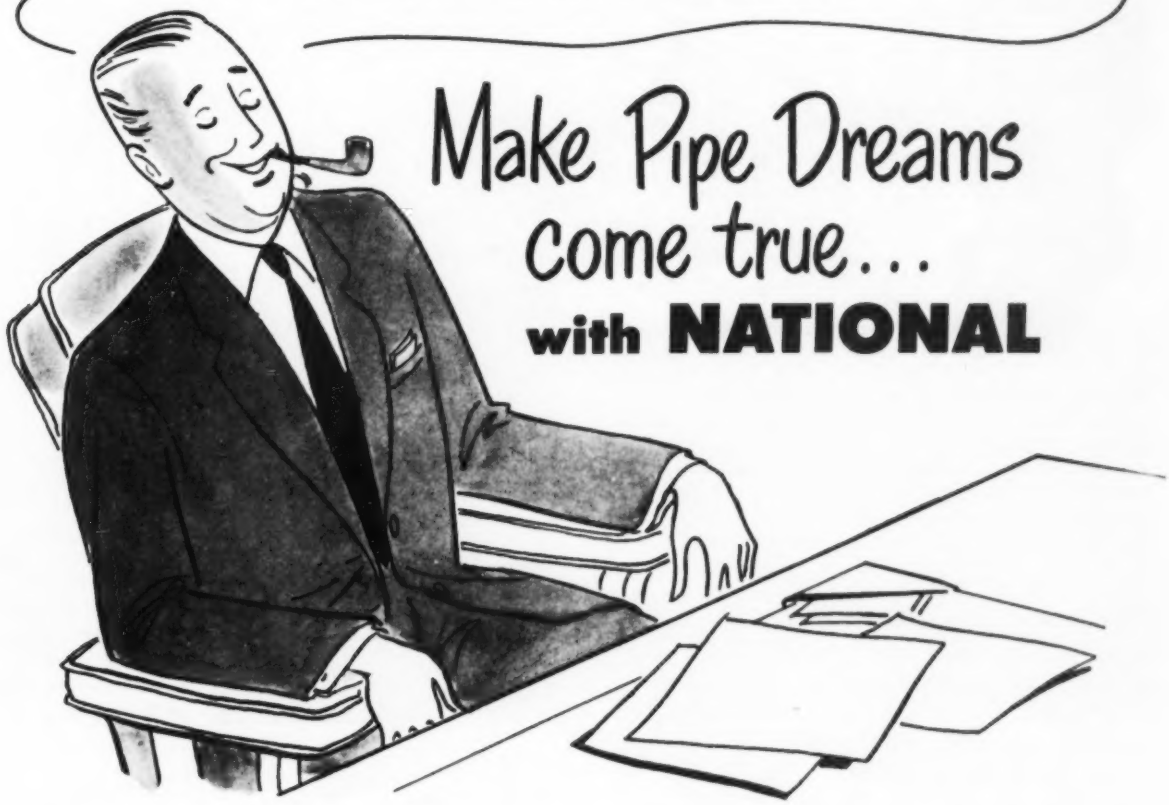
ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

5548

SPECIFY *ONE* WORRY-FREE PIPE . . . THAT HAS *ALL* DESIRED QUALITIES . . . MEETS ALL SERVICE REQUIREMENTS . . . LOW FIRST COST, MINIMUM MAINTENANCE.



Make Pipe Dreams come true... with NATIONAL

If you have been wishing you could find *one* brand of pipe that would meet *all* service requirements, it's high time you got better acquainted with National Steel Pipe. So many architects, engineers and contractors have found the National line the solution to so many piping problems—during more than half a century—that they have made National the largest selling pipe in the world.

That preference was earned by the uniform high quality and complete dependability that is built into U·S·S National Steel Pipe. From raw material to finished pipe, every step in its production is controlled by one responsible organization. Improved steel-making facilities, special manufacturing processes and the lifetime experience of many skilled craftsmen, combine to produce pipe whose metallic structure, strength, sound joints, superior welding, bending and threading properties, assure low cost installation and long trouble-free performance.

That is why shrewd pipe buyers—generation after generation—continue to specify National, whenever they need pipe. They know that it fits every purpose at a cost that fits every purse.

So, whenever you need pipe for any type of building, make your pipe dreams come true. Get U·S·S National Steel Pipe.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

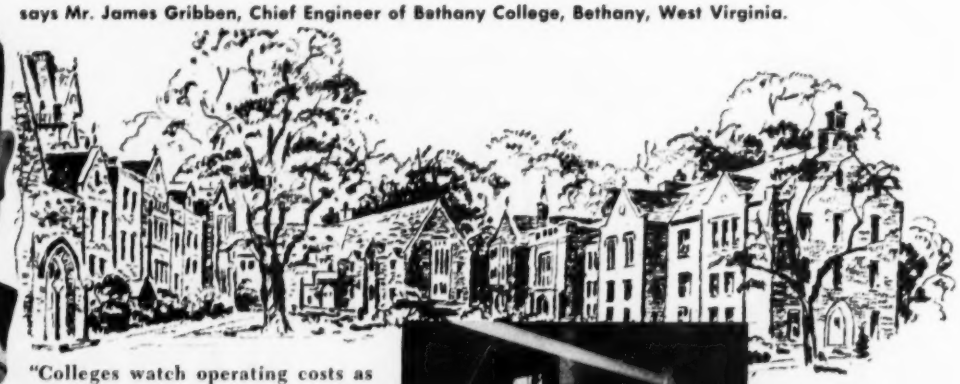
U·S·S NATIONAL Steel PIPE

UNITED STATES STEEL

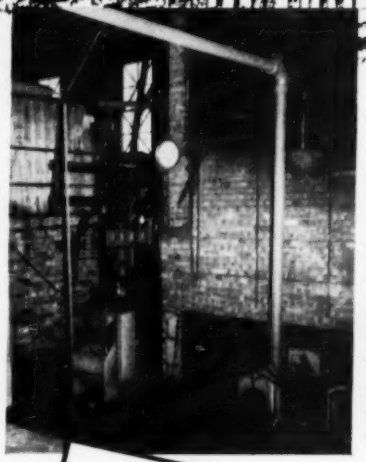
"We 'educated' our College Heating Plant...

with a modern coal installation we saved more than a third of our fuel bill,"

says Mr. James Gribben, Chief Engineer of Bethany College, Bethany, West Virginia.



"Colleges watch operating costs as closely as any business firm—and one big item for our college is the heating bill. That's exactly why Bethany went to the expense of putting in new coal heating equipment! Our old system supplied heat for sixteen buildings—to the tune of 2,600 tons of coal a year. Our new installation, with its automatic stoker, does the same job using only 1,650 tons. That's a fuel saving of 38.9%! Our eyes certainly have been opened to the efficiency and economy of *bituminous* coal—especially when it's burned with modern equipment."



Here's Bethany's new boiler room, showing the pipe of the automatic stoker. **THIS MODERN EQUIPMENT WILL PAY FOR ITSELF, THROUGH FUEL SAVINGS ALONE, IN LESS THAN TWO YEARS!**

Modern combustion installations can add anywhere from 10% to 40% to the energy obtained from the same amount of coal in years gone by. Great advances have been made in coal- and ash-handling equipment, too—cutting labor costs—making coal as clean and convenient to use as any fuel.

If you're planning to modernize your present installation—or thinking of building a new plant, call in a competent consulting engineer. He'll show you how a modern coal system designed to meet your specific needs can save you money and serve you better!

And don't forget—you'll always be able to get the coal you need. America's coal industry is the most efficient in the world. America's coal reserves are ample for centuries to come. Right now and for the future, too, coal users can be assured of a dependable fuel supply at reasonable prices.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Washington, D. C.

If you're running your own steam plant—for heat or for power—you just can't afford to ignore these facts!

COAL in most places is today's most economical fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

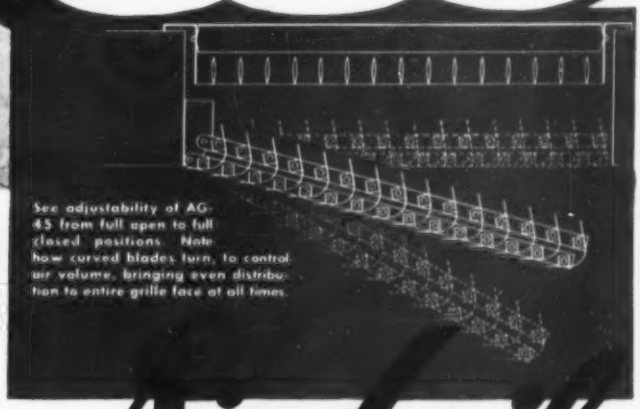
COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY *FOR LOW COST*

YOU CAN COUNT ON COAL!

NEW ADJUSTABLE DOUBLE DUTY AIR VOLUME EXTRACTOR & CONTROLLER

FACTORY ASSEMBLY SAVES UP TO 50% OVER SLOW HAND-MADE METHODS



See adjustability of AG-45 from full open to full closed positions. Note how curved blades turn, to control air volume, bringing even distribution to entire grille face at all times.

11 TREMENDOUS ADVANTAGES:

1	FACTORY ASSEMBLED
2	INSTALLS WITH 2 SCREWS
3	Double Duty Extractor & Vol. Controller
4	Replaces Extra Vol. Controller
5	Equalizes Air Distribution & Air Flow
6	Turns Air from Main Duct
7	Reduces Pressure Losses
8	Stops Excess Turbulence
9	Low Cost
10	Rattle Free
11	14 & 20 Gauge Steel

AirFoil
AIR CONDITIONING OUTLETS

Slash unit costs with this amazing new Titus AG-45. Make it easy for yourself to *keep bids low.* Use this *cost saver* to beat competition. Eliminate the extra work of putting in volume controllers. Save time, labor. IMPROVE THE AIR CONTROL EFFICIENCY OF EVERY INSTALLATION. Get complete free information now. Order a sample AG-45 today. Remember, not until you have one of these AG-45s in your hand, can you see its *amazing cost-saving value.* IMMEDIATE DELIVERY.

Free

Check Type of Grille on Which Information Is Desired:

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Industrial grilles
- ☐ Special made-to-order grilles.

TITUS MANUFACTURING CORP., WATERLOO, IOWA

- ☐ RUSH information on AG-45 Extractor & Controller
- ☐ Send complete catalog
- ☐ Send literature on above checked items

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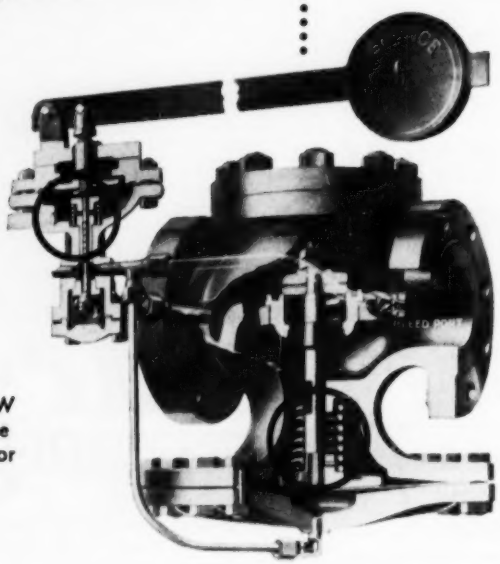
HOW SPENCE DESIGN...

...protects springs

FOR LONGER LIFE

In the Spence Regulator, the springs are out of the path of the steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life. This is only one of the many Spence design features that assure dependable, accurate regulation year after year. That means less down-time, less time and money wasted on replacement of parts.

Spence makes a wide line of automatic regulating valves: Pressure, Temperature, Differential Pressure, Back Pressure, Pump Governor and many other types. Write for bulletin 100 giving full details.



Type EW Pressure Regulator

A few other design features:

SECO METAL SEATS AND DISCS— Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

LARGE BALANCED METAL DIAPHRAGM located in a cooled zone with a condensate seal above and below it, never has to be replaced under normal conditions.

PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . reduces valve stem wear and eliminates time-consuming maintenance.

Spence

SPENCE ENGINEERING COMPANY, INC.

WALDEN, NEW YORK

SE133

ONE OF THE MOST COMPLETE LINES IN THE INDUSTRY

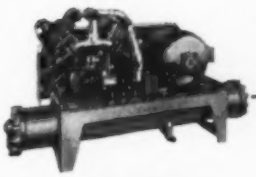
NEW improved

Curtis CONDENSING UNITS

at NEW, LOW PRICES

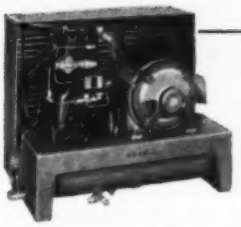
All with these Famous Curtis Features:

- TIMKEN TAPERED ROLLER BEARINGS
- POSITIVE LUBRICATION
- OIL LEVEL SIGHT GLASS
- SLOW SPEED OPERATION FOR LONG LIFE AND HIGH EFFICIENCY



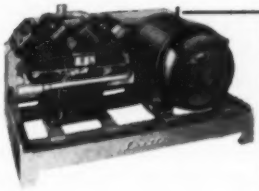
WATER COOLED CONDENSING UNIT

Low, Regular and High Temp., from ⅓ H.P. to 50 H.P.



AIR COOLED CONDENSING UNIT

Self-contained, remote, truck type, from ¼ H.P. to 3 H.P.



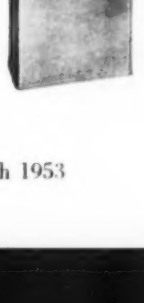
COMBINATION AIR AND WATER COOLED CONDENSING UNIT

Plenty of reserve capacity for extreme hot weather. Operates primarily as air cooled unit with shell and coil condenser as auxiliary in case of overload. From ⅓ H.P. to 3 H.P.

COMPRESSOR UNITS

For use with evaporative condensers, low temperature cooling, processing and air conditioning installations, from 3 H.P. to 50 H.P.

Plus a complete line of packaged units in six sizes 2-3-5-7½-10-15-H.P.



For Immediate Information — **Use This Coupon**

CURTIS REFRIGERATING MACHINE DIVISION 72H
of Curtis Manufacturing Company
1950 KIENLEN AVENUE, ST. LOUIS 20, MISSOURI

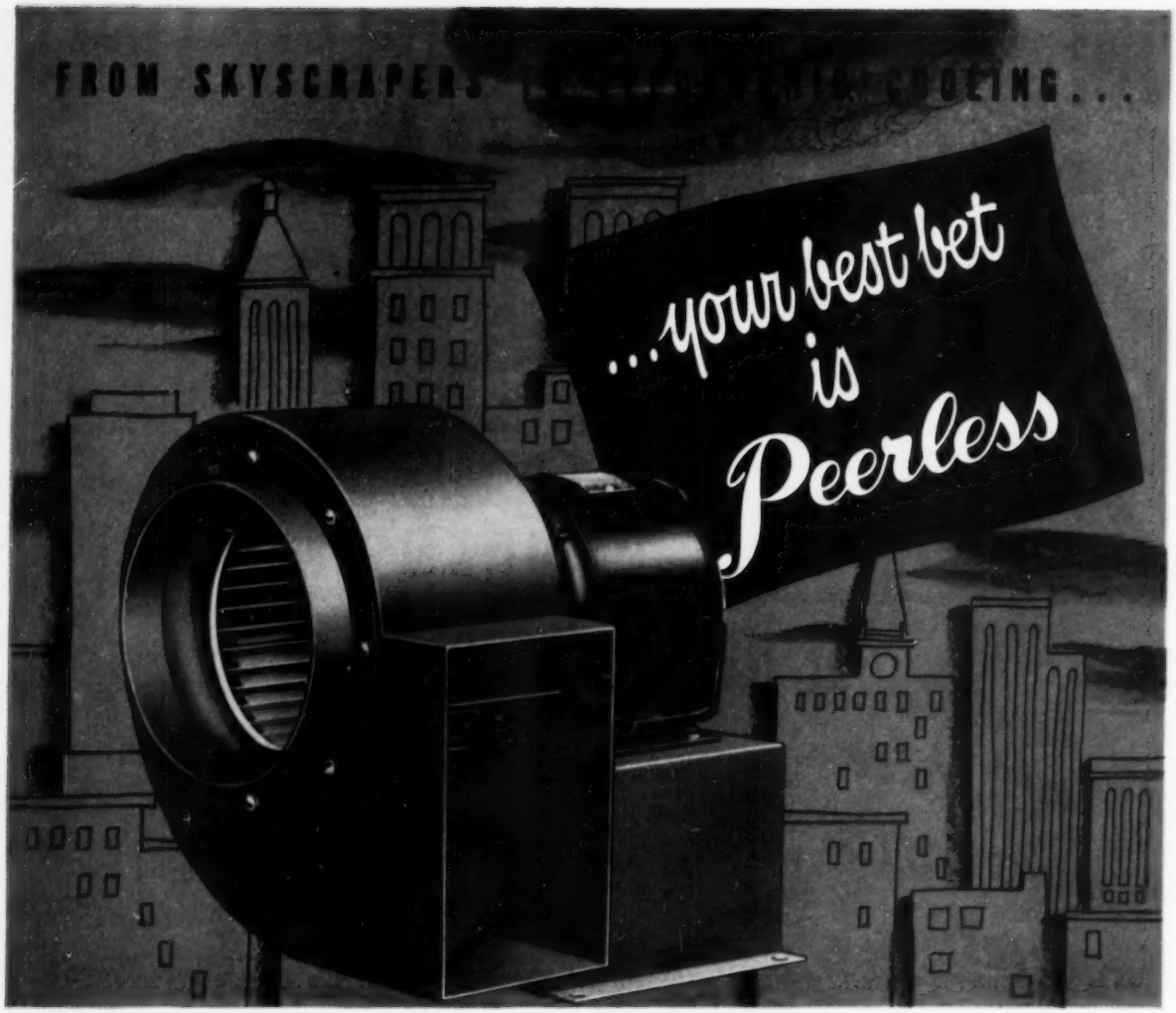
I am interested in direct factory franchise. Send complete details.

COMPANY NAME_____

STREET_____

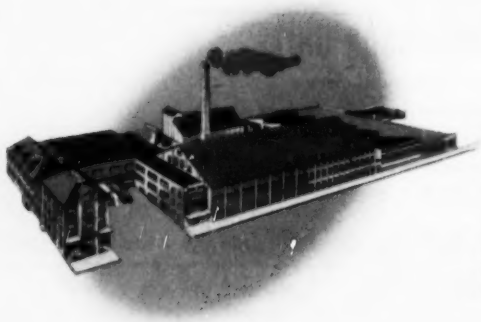
CITY_____ ZONE____ STATE_____

SIGNED_____



YOU HAVE FACTORY CONTACT-DIRECT

FOR FANS AND BLOWERS WITH JOB-MATCHED *Peerless* MOTORS



Whatever your needs . . . large or small, many or few . . . Peerless has the answer with a complete line of quality-built fans and blowers. If you need special services, rapid delivery, engineering aid or special designs . . . you'll get them and get them quickly at Peerless.

Since 1893, Peerless Electric has been headquarters for all types of air-moving equipment, so, no matter what your plans . . . whether you're designing skyscrapers or cooling electronic mechanisms, it'll pay you to get the facts first from Peerless. Write today for illustrated catalog SDA 160.

"SMOOTHEST PERFORMERS ON THE MARKET"

FAN AND BLOWER DIVISION

THE PEERLESS ELECTRIC COMPANY

1409 WEST MARKET ST. . WARREN, OHIO

the

"coming thing"

in intermediate-capacity

cooling has already arrived!

Marley Double-Flow Aquatower

Just one year ago, Marley introduced the Double-Flow Aquatower, a totally new concept in intermediate-capacity water cooling, to the air conditioning and refrigeration industry.

Trade acceptance was immediate. Engineers and contractors quickly recognized that the new towers offered every advantage of Marley patented Cross-Flow cooling, while retaining the operational simplicity of Marley's smaller Aquatowers. Everyone — architect, engineer, contractor, and customer — heartily approved the new design that reduced usual tower height up to 66%.

Today Double-Flow Aquatowers are in service throughout industry and commerce — on supermarkets, bus terminals, manufacturing plants and many other installations that require 50 or more tons of refrigeration. Readily available in a complete range of sizes, in all steel or wood with asbestos cement board casing, the Double-Flow Aquatower is the modern answer to your intermediate-capacity cooling problems.

producers of
DOUBLE FLOW TOWERS
AQUATOWERS
NATURAL DRAFT TOWERS
CONVENTIONAL TOWERS

MARLEY

The Marley Company

Kansas City, Missouri

..FACTS ABOUT CORK for Low Temperature . . .

CORK is one of the most useful materials known to man. Not only has it been in service longer than history can record, but its use has greatly increased with the need for modern industrial efficiency and economy. The reason for this is that Cork is completely unique in its physical structure and qualities. There's *nothing* like Cork!

1. Cork is MONEY-SAVING! Millions of dead-air cells in every square inch of Cork insulation cause it to serve as a most efficient *natural* barrier to heat flow. By its use, refrigeration is conserved to the most practical limits.

2. Cork is LONG-LASTING! Cork has high structural strength and is a most durable material. It continues to serve for many years at highest efficiency.

3. Cork is TIME-TESTED! The use of Cork insulation has kept pace with the development of refrigeration and cold storage. Its wide acceptance in these "heavy-duty" industries is due to its proved record for more than 40 years.

Write for FREE copy of Mundet Insulation Manual

4. Through more than 80 years as Cork specialists, we are able to preserve Cork's natural advantages in Mundet insulating products. Mundet engineers give you responsible assistance in building or expanding low temperature facilities. Let us help you secure low operating cost and maximum service. Mundet Cork Corporation, Insulation Division, 7101 Tonnelle Avenue, North Bergen, N. J.

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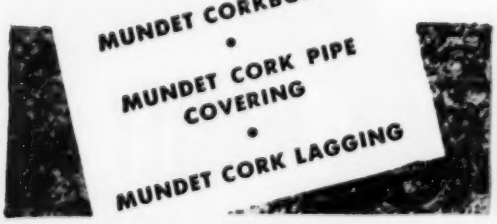
35 Booth Avenue, Toronto

Write us for name of our nearest representative if there is no Mundet office in your city.



MUNDET
CORK INSULATION

CONSERVES LOW TEMPERATURE

LOOKING DOWN YOUR PIPELINE . . .

. . . what do you see? Dependability . . . or frequent failure; long, economical life . . . or costly maintenance; W-S FORGED STEEL FITTINGS . . . or the ordinary kind that are a source of constant trouble and expense?

W-S Screw-end and socket-weld fittings are the *only* type that become integral parts of your steel pipe-lines . . . their forged steel construction matches that of the pipe or tubing in chemical and physical properties, in strength, weight and resistance to pressure . . . heat . . . corrosion.

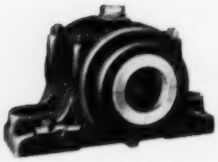
Whatever your pipe or tubing application, you can profit from the permanence of W-S Fittings. Initial cost is often *less;* final cost is always *least.* Literature is available . . . write for it.

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

132 ALDENE RD., ROSELLE, NEW JERSEY

WHEREVER QUIET IS REQUIRED

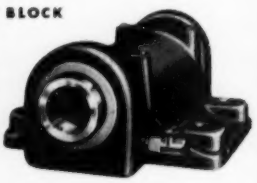


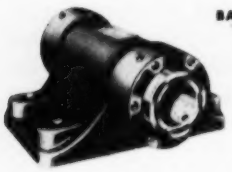
SLEEVOIL PILLOW BLOCK
A precision-built, ring-oiling babbitted bearing, self aligning and exceptionally quiet in operation.

WATER-COOLED SLEEVOIL
Sleevoil Pillow Block, designed for industrial applications where high temperatures are encountered.

DODGE BRONZOIL
Capillary bronze bushing has capacity of one-third its volume in oil. Reservoir with close fitting wick around bushing provides ample lubrication. Both pillow blocks and flange units.

BRONZE BUSHED PILLOW BLOCK
Designed for arrangement No. 2 installations. Two bronze bushings of high lead content mounted in one cast iron housing. Special T-section rings for dependable lubrication.





BALL BEARING PILLOW BLOCK
For anti-friction installations. Two single row, deep groove ball bearings in one cast iron housing. Extended inner races carry the shaft.

CALL THE TRANSMISSIONEER
your local Dodge Distributor, for information about the entire Dodge line of bearings for fan and blower service. Look for his name in the Classified Telephone Directory under "Power Transmission Equipment," or write to the factory.

DODGE BEARINGS
FOR FAN AND BLOWER SERVICE

FOR INSTALLATIONS in hospitals, auditoriums, office buildings—wherever quiet operation is essential, Dodge offers the perfect answer to the bearing problem. Dodge manufactures a *complete line* of bearings for fan and blower service, all engineered and precision-built for exceptional quietness in operation.

The Dodge line has been developed in close cooperation with the manufacturers of fan and blower equipment, to meet the specialized requirements in this field, efficiently and economically. For complete information on Dodge fan and blower bearings see your Dodge Distributor—or write the factory.

DODGE MANUFACTURING CORPORATION
1600 UNION STREET, MISHAWAKA, INDIANA

DODGE
of Mishawaka, Ind.

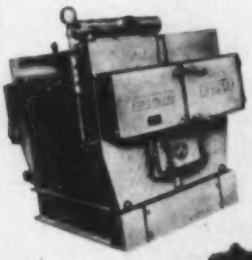
NAMEPLATES
FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

GREATEST ADVANCE IN A DECADE IN COMMERCIAL BOILER DESIGN

SPENCER'S LOW-WATERLINE BOILER

Flattened out to solve low-headroom and excavation problems!

Divided into two watertight sections for easier entrance through narrow doorways!



SPENCER

also offers Design Dividends

IN RESIDENTIAL BOILERS!

Unique warp-proof door frames—no gas leakage, since these door frames are precision-ground and extensions of the water walls.

Exclusive peaked fireboxes—clean, smokeless, efficient, because of extra-high combustion chamber.

Special staggered boiler tubes—more rapid water circulation, quicker heat absorption.

Interchangeable base panels—front and rear permit quick installation of brickwork.

"C" SERIES: 9 sizes—from 700 to 3,000 sq. ft., steam. Available with standard or extended beauty jackets and service water coils.

"R" SERIES: 6 sizes—from 320 to 1,100 sq. ft., steam. Available with beauty jacket and service water coils.

Specify **SPENCER**

...THE QUALITY LINE

SPENCER HEATER

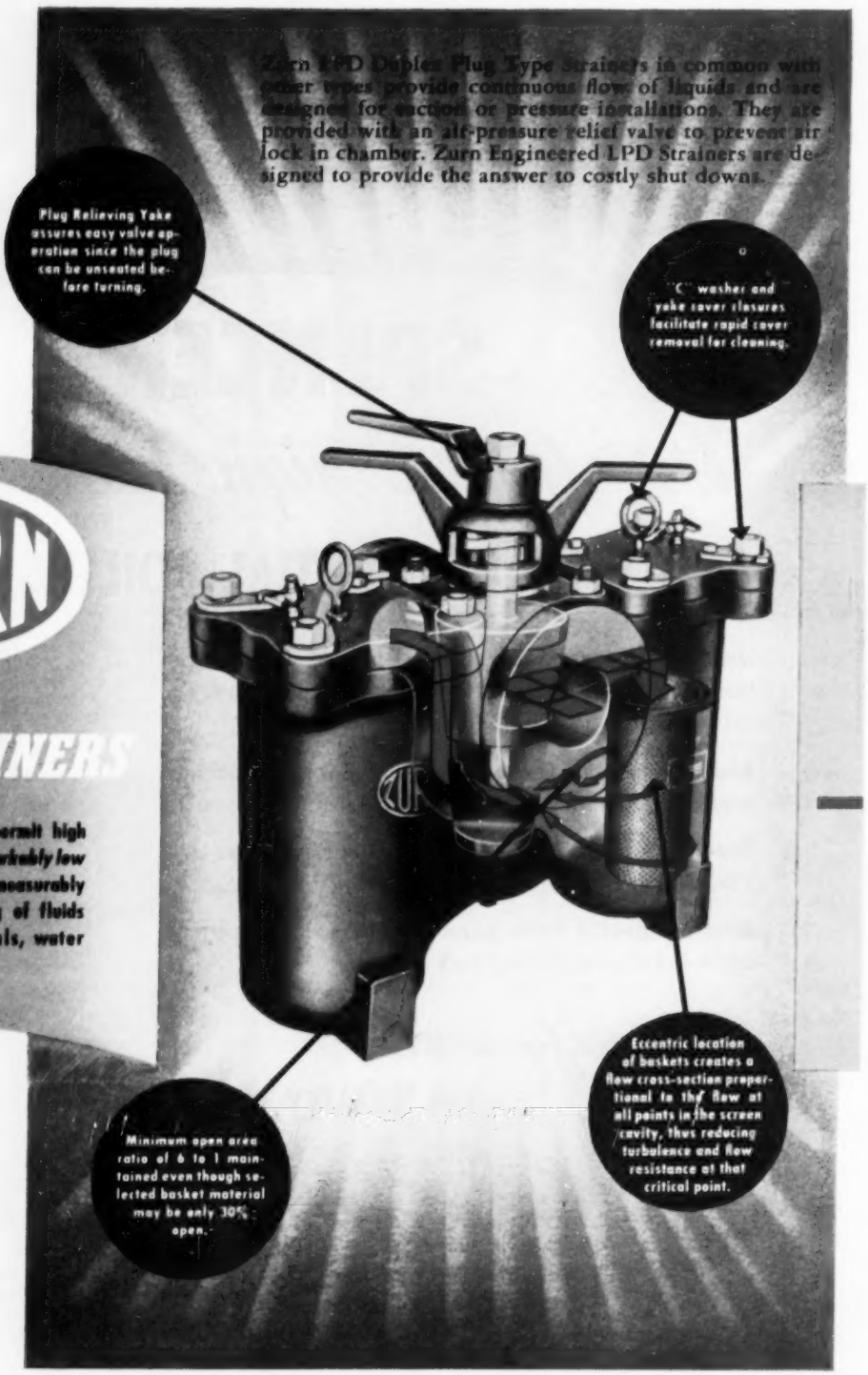
LYCOMING-SPENCER DIVISION

WILLIAMSPORT LYCO PENNSYLVANIA

SBI

H

You can maintain more of the


Zurn LPD Duplex Plug Type Strainers in common with other types provide continuous flow of liquids and are designed for suction or pressure installations. They are provided with an air-pressure relief valve to prevent air lock in chamber. Zurn Engineered LPD Strainers are designed to provide the answer to costly shut downs.
Plug Relieving Yoke assures easy valve operation since the plug can be unseated before turning.
"C" washer and yoke cover closures facilitate rapid cover removal for cleaning.
Eccentric location of baskets creates a flow cross-section proportional to the flow at all points in the screen cavity, thus reducing turbulence and flow resistance at that critical point.
Minimum open area ratio of 6 to 1 maintained even though selected basket material may be only 30% open.

ZURN

engineered

LPD STRAINERS

Zurn LPD Strainers permit high rates of flow with remarkably low pressure drop and immeasurably improve the handling of fluids such as oil, chemicals, water through pipe lines.

Copyright 1953

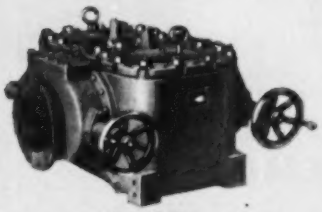
Full-Rated Pressure with . . .

ZURN Engineered Low Pressure Drop STRAINERS

Zurn Low Pressure Drop (LPD) Strainers are design improved for correct circularity. They have ample waterways; smooth inner walls; correctly sized and perforated baskets, eccentrically positioned, all of which combine to reduce pressure loss and afford maximum protection for all types of mechanical units connected with pipe lines. Zurn LPD Strainers are held to close tolerances for materials, shapes, and dimensions, assuring the utmost in strength and safety and continuous operation.

Zurn LPD Strainers are widely used to protect close-tolerance control devices and delicate mechanisms, also to protect product purity. They make continuous production processes possible. Zurn Fluid Handling Engineers are available for consultation on your particular problem.

There is a ZURN LPD Strainer for every fluid handling purpose



Zurn Duplex Gate Type Multi-Basket Strainer.

Zurn Simplex Strainer. Available in offset and straight-through types.

Zurn "Y" Type Strainers available in any cast material and for high pressures.

Zurn Duplex Plug Type Strainer.

Zurn LPD Strainer applications include fluid handling lines for lubricating and fuel oil, and oil during the refining process; a wide range of chemicals produced and used by the various process industries; public utility power plants; power stations; industrial plants; ships and high temperature installations. Zurn Fluid Handling Engineers are available for consultation.

Pat. & Pat. Pending

J. A. ZURN MFG. CO.

INDUSTRIAL DIVISION • ERIE PA., U. S. A.
In Canada: Canadian Zurn Engineering Ltd., Montreal, 25, P. Q. Canada

Write for LPD Strainer Manual Data No. 952.

This manual includes previously unpublished pressure drop data and gives useful, factual information on fluid handling.

J. A. ZURN MFG. CO.

Industrial Division, Erie, Pa., U. S. A.
Please send me Zurn LPD Strainer Manual Data No. 952.

Name_____

Position_____

Company_____

Street_____

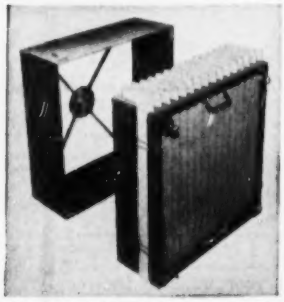
City and State_____

Please attach coupon to your business letterhead—Dept. HPAC

Photographed by Torkel Korling

Architects: Skidmore, Owings & Merrill and E. C. Hooton *Mechanical Engineers:* Cary B. Gamble Associates
Mechanical Contractors: Emile A. Barst Company

It has been said of the Pan American Life Insurance building in New Orleans that: "it will rank with the best in the record of architecture of our time."



This is an ELECTRO-PL unit—the only electronic air cleaner with the "double indemnity" feature.

DOUBLE INDEMNITY

for Pan American Life with High Efficiency

Electro·PL
FILTERS

Pan American Life Insurance Company's new home in New Orleans is an outstanding example of modern planning. Air, cleaned electronically, as well as conditioned and humidified, is a part of the ideal working atmosphere created for this recently completed office building.

AAF's ELECTRO-PL was selected as the air filtration equipment for several reasons including the important "double protection" feature. Here's how it works.

The ELECTRO-PL combines the advantages of higher efficiency with positive air cleaning. If, through a power failure, the electronic action should become inoperative, the air will continue to be filtered by one of the most efficient dry-type filtering media ever developed. A "double protection" feature offered by no other electronic cleaner.

Where modern planning calls for electronic air filtration look to AAF for the best in engineering and design. Call your nearby AAF representative for complete details on ELECTRO-PL . . . or write direct to us for Bulletin No. 257.

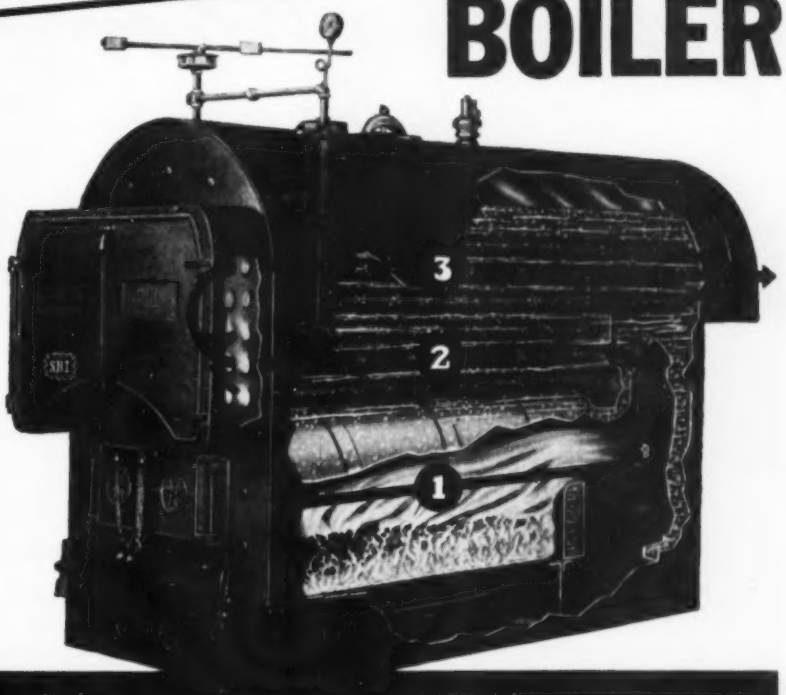
AAF

American Air Filter
COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

This is the Compact Type **STEEL BOILER**

with the famous

BURNHAM FIRE TRAVEL*



***3 times-back-and-forth fire travel means heat transfer is more efficient — you get more BTUs per unit of fuel!**

THE BURNHAM "COMPACT TYPE" Welded Steel Boiler with this famous feature is notable for low flue temperatures, high boiler efficiency and low fuel costs. Capacities for SBI Steam Hand-fired range from 3,000 to 35,000 sq. ft. and SBI Steam Automatic from 3,650 to 42,500 sq. ft.; SBI Hot Water Hand-fired range from 4,800 to 56,000 sq. ft. and SBI Hot Water Automatic from 5,840 to 68,000 sq. ft.

Long experience and intensive research have produced in this efficient BURNHAM Steel Boiler the last word in quality and dependability.

Some of its outstanding features are: Large steam dome permitting quick, easy steaming without priming. Rapid, continuous water circulation for efficient heat transfer. All sediment settles away from hot surfaces. Low water line for easy installation and piping. Plenty of clean-out plugs.

For schools, apartments, greenhouses and similar installations the BURNHAM "COMPACT" Steel Boiler provides dependable low cost heat. Send for 8 page catalog with full details and ratings.

Copper coils, storage or tankless type, can be installed in all sizes for an abundant supply of domestic hot water.

Burnham Corporation

"PIONEERS OF RADIANT BASEBOARD HEATING"

IRVINGTON, N. Y., Dept. HP-33

STEEL BOILER INSTITUTE · SBI · HEATING · PROCESS · POWER

Burnham RADIANT HEATING SINCE 1861

BURNHAM CORPORATION
Irvington, New York Dept. HP-33

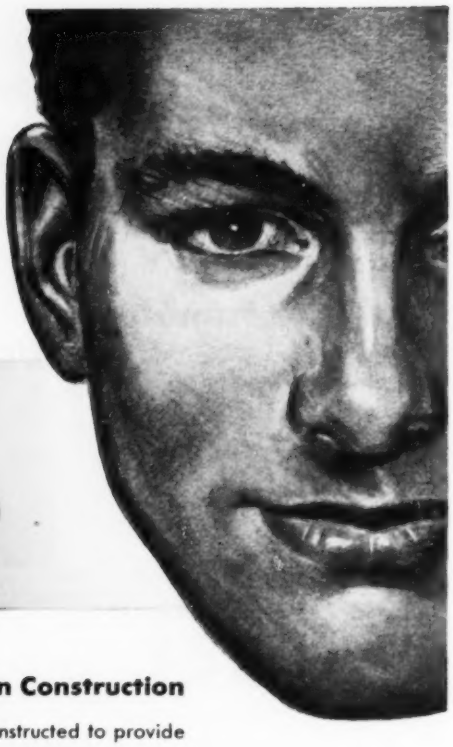
Please send copy of catalog SB-104 giving details and ratings on Burnham Steel Boilers.

Name _____

Address _____

City _____ State _____

What does Vulcan mean by...



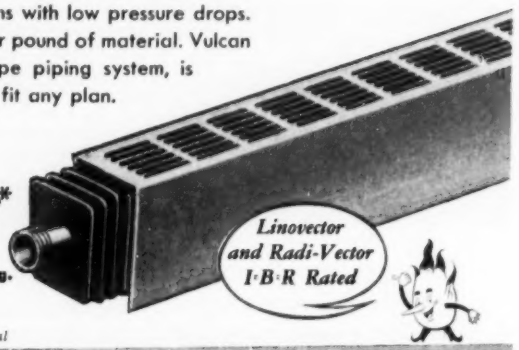
THE VALUE IN VULCAN?

In Vulcan Design... In Vulcan Material... In Vulcan Construction

Vulcan Radi-Vector and Linovector Radiation is compactly designed for high output with attractive covers which will blend with any residential or commercial decorative scheme. Vulcan radiation requires fewer fittings. It comes in convenient lengths up to 12' . . . no field-cutting necessary and can be furnished curved for unusual installations.

Vulcan steel radiation is fabricated from quality pressure tube in steel or copper. Fins permanently imbedded in tube surface for best heat transfer.

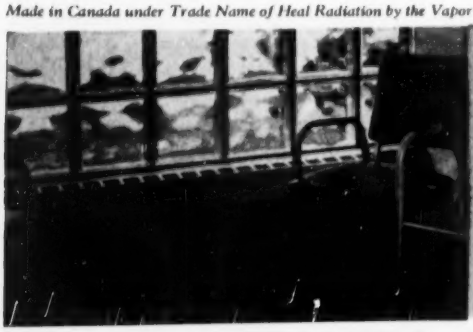
Vulcan radiation is constructed to provide wide range of sizes and outputs . . . most complete line in the industry. Large tubes permit long runs with low pressure drops. High output per pound of material. Vulcan will fit any type piping system, is engineered to fit any plan.

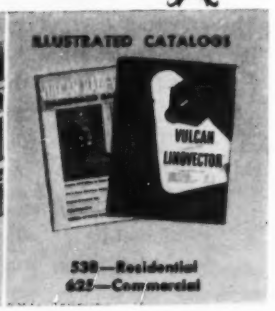


Linovector* (COMMERCIAL)

*Trade-mark Reg.

Made in Canada under Trade Name of Heal Radiation by the Vapor Car Heating Co. of Montreal





Representatives in Principal Cities

THE VULCAN RADIATOR CO.

16 Francis Ave. Hartford, Connecticut

The Most Complete Line (V) In The Industry

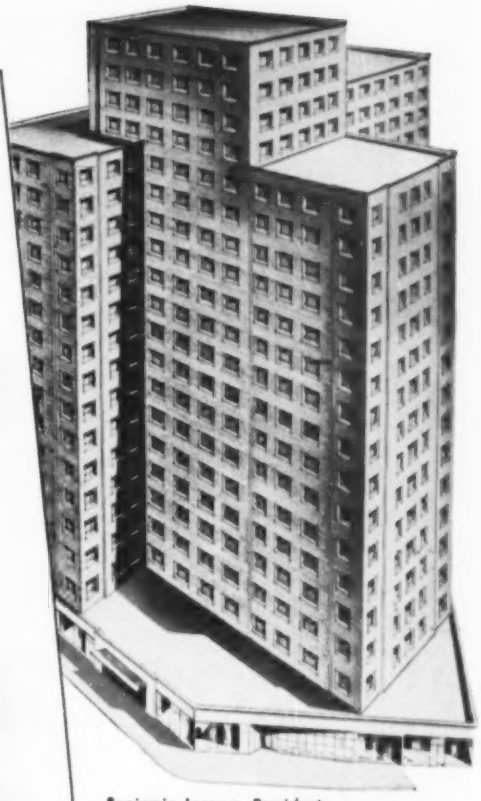
Over 27 Years A Leader in Fin-Tube Radiation

ANOTHER REPORT OF READING
COPPER TUBING *"ON THE JOB"* . . .

10 MILES of READING COPPER TUBING

in Pittsburgh's Newest Hotel!

"Did Better Job . . . Used Fewer Fittings . . . Saved Time and Labor Costs" . . Says Contractor



Benjamin Lessner, President, Benjamin Lessner Co., Inc., Philadelphia, Pa., Plumbing, Heating and Air Conditioning Contractor on the Carlton House, Pittsburgh, Pa.

The Carlton House, Pittsburgh's palatial new 600-suite hotel, is one of 16 multi-story hotel and apartment buildings, erected during the past several years, in which Benjamin Lessner Co., Inc. has installed Reading Copper Tubing. The Carlton House is completely air conditioned, using forced circulating water—heated for winter comfort and chilled for summer cooling. For this system and the building's hot and cold water lines, Lessner engineers estimate approximately 10 miles of Reading Copper Tubing were required. Reasons given by Benjamin Lessner for his company's preference for Reading Copper Tubing include uniform wall thickness, precision manufacture to close tolerances and ease of bending with ordinary tools and methods which greatly reduces the number of fittings. On one job, Lessner reports a saving of 4200 copper sweat ells. Where joints were necessary, Reading Copper Tubing was easy to fit with standard sweat fittings.

Reading Copper Tubing is available in soft and hard temper types in a wide range of sizes. It comes in handy straight lengths and coils—a tubing for every type of installation in hot and cold water lines, radiant panel heating, air conditioning, underground service and processing lines. Specify Reading Copper Tubing when you order from your plumbing and heating supply wholesaler.

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

OFFICES AND EASTERN DISTRIBUTION DEPOT:
36-12 47th Ave., Long Island City, N. Y. • STillwell 6-9200
WORKS: READING, PA.

READING COPPER-BRASS TUBING

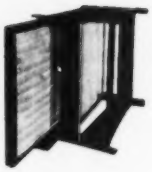
DISTRIBUTION DEPOTS: Reading, Pa. • Long Island City, N. Y. • Houston, Texas, 1121 Rothwell St. Chicago, Ill., 724 W. 50th St. • Atlanta, Ga., 690 Murphy Ave. S.W. Unit 5, Bldg. B

PORTABLE

FRESH'NER

PUR-ETTE

FILTER FOLD



PANEL ADSORBER

CANISTER

PORTABLE

Remove Odors Completely with

Pur Air

activated, coconut-shell carbon equipment

PARTIAL-AIR-BY-PASS

FIXED MOUNT

Pur Air ACSC* equipment actually removes odors . . . doesn't hide or mask them. The odors and gases stay right in the carbon, and the purified air is returned ready for re-use. Great economies are realized in heating or cooling costs by such re-use of room temperature air.

Pur Air makes use of the time-proved principle of the gas-mask, using activated carbon to adsorb odors and gases. Only pure coconut-shell carbon is activated for Pur Air equipment, since over 15,000 tests prove it to be the most effective material.

For air intake and recirculation ducts adsorber plates, filter-fold, partial-air-by-pass or canisters are used. Portable units are used in hospital wards, veterinary hospitals, taverns, cocktail lounges, conference rooms, etc. . . . fixed mount in industrial areas and cold storages. The Fresh'ner is used for rest rooms and dressing rooms. The Pur-Ette is just the thing for home use, in kitchen or lavatory.

WRITE FOR SPECIFICATION SHEETS TODAY

In Pur Air equipment you get the maximum Pur Air ACSC* for your money . . . and after all it's the carbon that does the job. Quality control is positive, because Pur Air is the ONLY manufacturer that both PRODUCES activated, coconut-shell carbon and BUILDS the equipment, too.

***ACSC: activated, coconut-shell carbon**

Pur Air DIVISION

BARNEBEY-CHENEY *Company*

(Successor to American Solvent Recovery Corp.)

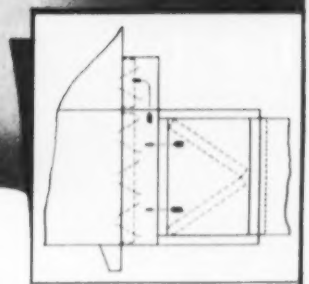
N. Cassady at Eighth Columbus 19, Ohio

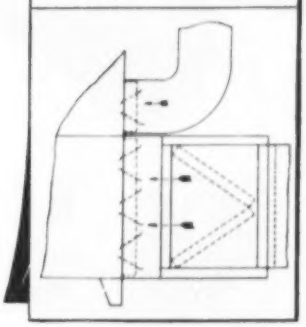
WORLD'S LARGEST PRODUCER OF GAS-ADSORBENT CARBONS

KENNARD Engineered

SPECIAL WITH MANY STANDARD WITH KENNARD

Exposed View
Damper





Opposed-Acting Dampers

Architects, Engineers and Contractors prefer opposed-acting Dampers for these features:

Uniform increments of opening for each degree of rotation of the damper blades, assure air flow characteristics that simplify the control problem.

Balanced forces assure freedom from blade flutter.

Opposed-Acting Dampers are standard on all KENNARD air handling units.

Another special feature by Kennard is a choice of By-Pass Arrangements, illustrated at right.

Write for name of nearest representative and catalogs needed.

KENNARD CORPORATION · 1817 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

Get balanced performance through matched equipment

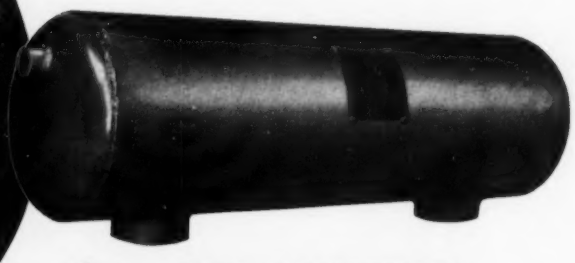
TEAM-UP Acme products for top efficiency

Acme DRY-EX WATER CHILLER

High efficiency is assured by Acme's method of making available multiple combinations of water side baffle spacings and refrigerant heads. There is a design to fit each application from 5 to 260 tons and for fluid circulation rates from 10 to 600 gallons per minute.

Acme OIL SEPARATORS

For positive oil separation from ¼ to 100 H.P. you should specify the easy to install, economical to buy Acme oil separators. There is no gamble with the life of your compressor when you use an Acme oil separator.



Acme HEAT EXCHANGERS

Acme shell and tube type heat exchangers include 11 standard models with capacities from 3 to 200 tons. They feature low pressure drop and high performance. The extended bar type fin surface permits the maximum amount of surface being furnished in a minimum amount of space. System capacities have been greatly improved as result of liquid sub-cooling and the elimination of liquid slugging and flash gas.

Acme CONDENSERS

Acme has both shell and tube and shell and coil condensers available for use with either Freon or Ammonia refrigerants. There are well over a hundred standard sizes and capacities ranging from ½ to 700 tons. Each series of condensers within the Acme line was designed for a specific purpose. The exact model for your requirements is always available.

ACME PRODUCTS

ACME INDUSTRIES, INC.

JACKSON, MICHIGAN

Mfgs. of a complete line of Air Conditioning and Refrigeration Equipment

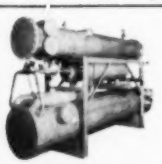
Evaporative Condensers
Cooling Towers
Floor-type Unit Coolers

Direct Expansion (Dry-Ex) and Flooded Liquid Chillers

Heat Exchangers, Oil Separators

Shell and Tube, Shell and Coil Condensers

Receivers, Pipe Coils



Packaged Liquid Chillers to 225 tons

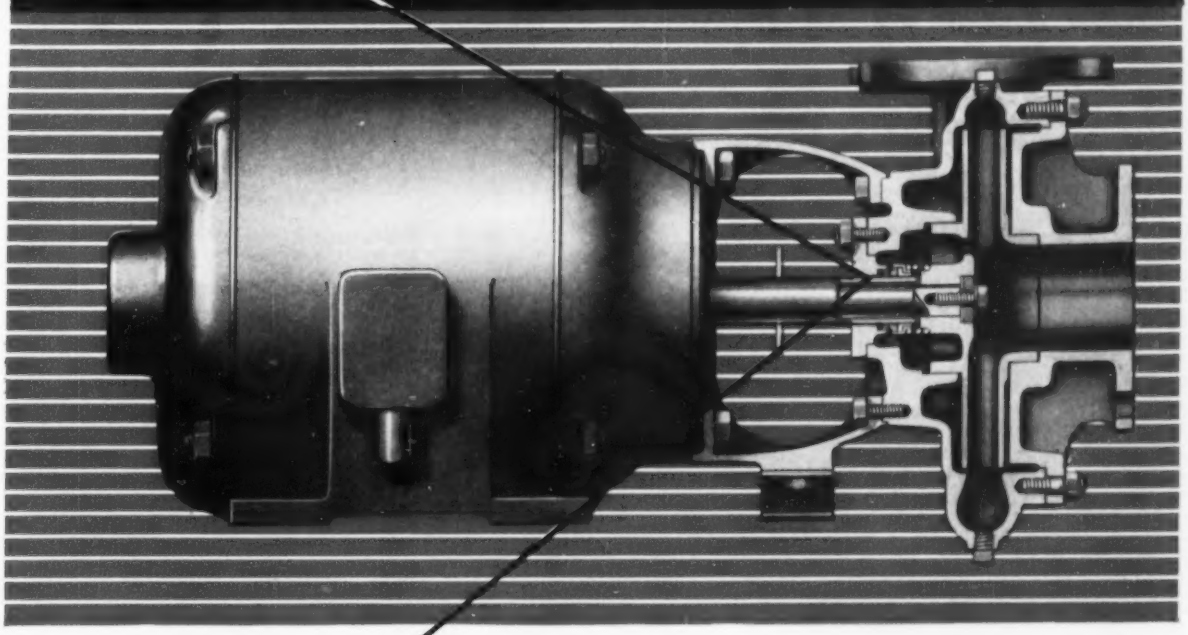
Flow-Temp Heat Pumps

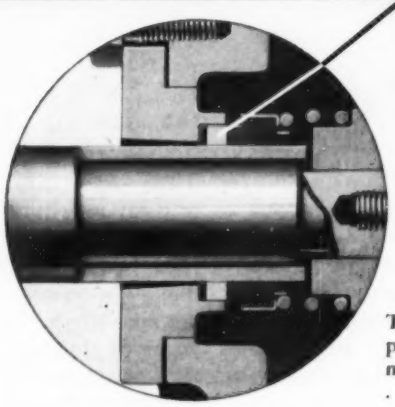
Flow-Cold Liquid Chillers

Convectors for Heating and Cooling

Continuously serving the refrigeration and air conditioning industry since 1919

NEW *Remite* SEAL ENDS LEAKAGE TROUBLES





Cross-section showing Remite Mechanical Seal.

B&G *UNI-BUILT*

SERIES 1531 CENTRIFUGAL PUMP

. . . a better pump for air-conditioning and refrigeration installations

The "REMITE" Mechanical Seal of this pump presents a revolutionary new development in pump design . . . eliminates leakage . . . assures long, trouble-free life.

A carbon seal ring faces on a "REMITE" floating seat—a new type of material, *so hard it will scratch glass*—wear-proof and corrosion-resistant! This Seal is self-lubricating.

Note the pump shaft . . . super-finished high grade steel . . . oversized for minimum deflection . . . quiet. The impeller is of sound hydraulic design, mechanically balanced, with balance ring and relief holes to reduce thrust. The heavy duty ball-bearing motor is normally furnished as drip-proof, but is also available in splash-proof, totally enclosed and explosion-proof models.

B & G Series 1531 Uni-built Pumps are made with capacities to 1200 GPM, heads to 400 feet.

Send today for catalog No. ET-452, giving complete engineering data on the B & G Series 1531 Uni-built Centrifugal Pump.

BELL & GOSSETT
COMPANY
Dept. RCW-5, Morton Grove, Ill.

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The New Louisiana Purchase

EVERY day America crosses a frontier—the frontier of a new market. It is the market created by an ever growing population. Since Pearl Harbor, our population has increased 23½ millions—more than all the people now living in the region west of the Mississippi once called the Louisiana purchase, that vast billion-acre area which provided us with geographical frontiers for a hundred years.

During 1952, 8,500 babies were born daily, increasing our population by nearly 3,000,000 people. New families and bigger families need more and bigger houses, more food, clothing, cars, roads, hospitals, churches, schools. Their needs call for continuing and increasing production from farms and factories.

There are those among us who say a decline in government spending will bring depression. But where is there room for depression when we add the population of another Minnesota or an Iowa to our nation each year—when the need for goods and services increases steadily? In fact, only by tapering off our vast programs of government spending can industry and business hope to provide sufficient goods to maintain our present standard of living and satisfy the demands of our ever growing population.

Let no one tell you America has crossed its last frontier.

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MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

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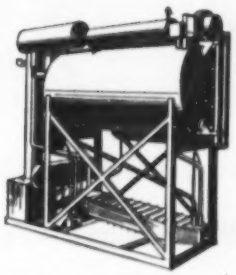
the dependable air conditioning equipment

He can rest assured because Servel has a well-deserved reputation for reliability and economy in meeting all air conditioning needs—comfort air conditioning, chilled water for industrial processing, precooling air for industrial applications.

Reliability—Because Servel Air Conditioning has *no moving parts* in the refrigeration system, there is nothing to vibrate or wear. It operates continuously at peak performance without loss of capacity and with minimum maintenance. A five-year factory warranty backs up the dependability of the famous Servel "no moving parts" design.

Economy—The Servel unit operates on steam at atmospheric pressure which can be obtained from any source—waste steam, waste heat or district steam. With simple controls, the Servel unit modulates to meet varying load conditions. Capacity can be reduced to as low as 50% with corresponding savings in steam consumption.



The Servel 25-ton water chiller has low floor loading, no vibration and quiet operation. It can be installed on any floor with most economical piping arrangement.

Investigate the proved advantages of Servel . . . There's a Servel unit or combination that will provide the best *in air conditioning at the lowest operating and upkeep cost. Mail the coupon* today *for full information.*

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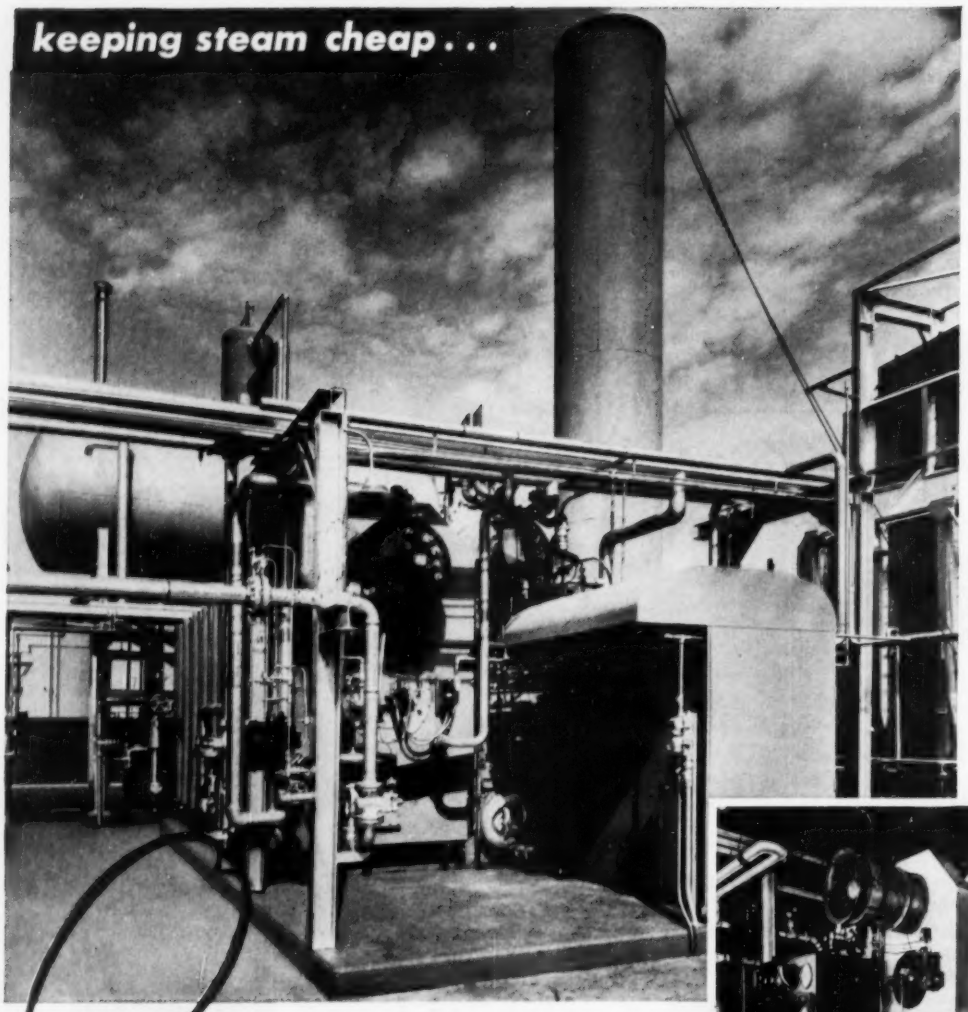
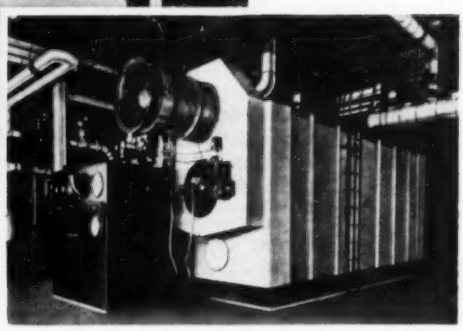


Outdoor installation of shop-assembled B&W Integral-Furnace Boiler, Type FM at a large Texas refinery.



Conventional indoor installation uses a minimum of valuable space.

Outdoors as well as indoors
SAVE with the
B&W Integral-Furnace Boiler, Type FM

Outdoor installation of the shop-assembled, *B&W Integral-Furnace Boiler, Type FM,* is an important cost-saving advantage that is gaining wide popularity with users in all sections of the country. A high percentage of units sold to date are for outdoor operation under year-round weather conditions.

A completely water-tight, rigid steel casing encloses the entire boiler and furnace of this compact B&W steam unit. Designed to permit proper expansion and contraction of the unit's various components resulting from seasonal temperature fluctuations, the casing is welded for additional strength and tightness. A blanket of mineral wool plus over-all high-temperature insulation of walls, floor, and roof, minimizes heat loss through radiation.

For installation outdoors or indoors, this versatile, self-contained B&W steam generator is available in steam capacities ranging from 2900 to 28,000 lb per hr, at pressures between 15 and 250 psi. Total steam capacity of units now in service and on order for over 50 different industries, utilities, and other users here and abroad exceeds 5½ million lb per hr.

OTHER COST-SAVING FEATURES

- Saves Erection Time and Cost
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- Handles Quick Load Changes
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- Low Maintenance
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- Burns Oil and/or Gas
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- Saves Space
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BABCOCK & WILCOX

Write for Bulletin G-76, for an illustrated, detailed description of the many other cost-saving features of this unique unit. The Babcock & Wilcox Company, Boiler Division, 161 E. 42nd St., New York 17, N. Y.

G-586

THE EDITOR'S PAGES

PRIDE IN THE INDUSTRY was perhaps the first and most noticeable reaction of those who attended the recent International Heating, Ventilating and Air Conditioning Exposition in Chicago. A record-breaker in space occupied, interest shown, and the caliber of the equipment displayed, it seemed to have the universal approval of those who came to see it and those on duty in the hundreds of exhibit booths. We know we enjoyed it — from both angles.

HOW CAN WE BEAT THE ENGINEER SHORTAGE?

WHAT'S TO BE DONE about the critical gap between American industry's increasing demand for engineers and the declining supply of graduates from engineering schools? That was the problem considered by more than 300 educators and industry representatives meeting at Northwestern University's Technological Institute for the school's fifth annual college-industry conference.

Clarence E. Deakins, dean of students, Illinois Institute of Technology, pointed out that each year the nation needs, for replacement alone, an estimated 30,000 new engineers. But next June colleges are expected to graduate but 24,000 — with this number declining to 19,000 in 1954 and to 17,000 in 1955.

As two parts of a suggested six-point program to increase the number of engineering students, he urged that there be earlier identification of engineering aptitudes and interests among secondary school students, and that industry increase its scholarship funds for talented students now lost to industry because they cannot afford an engineering education.

Training and using skilled assistants is one way to beat the engineer shortage, it was emphasized at the meeting.

Titus G. LeClair, manager of engineering for Commonwealth Edison and Public Service Co. of Illinois, said that requiring an engineer to handle all the details of his job is "our greatest source of wasted engineering talent."

"The obvious answer to this problem is to relieve the engineer of his paper work and other non-technical activities by giving him the help of a technical assistant, draftsman, clerk, or perhaps all three," he said. He asserted the graduate engineer can increase his working effectiveness at least 10 or 15 percent if surrounded by dependable technicians.

E. W. Seeger, vice president of Cutler-Hammer, Inc., speaking from the viewpoint of the registered professional engineer, said that the "best immediate solution for the engineering shortage is better utilization of engineers presently available." But he cautioned that if the number of engineering aides, assistants and technicians is materially increased "we should be certain that these people are properly classified so the progress made so far in the recognition of engineering as a profession is not lost."

The individual engineer has a responsibility — along with industry and the schools — in helping overcome the shortage of trained engineers, it was pointed out at the conference.

The working engineer will be more effective if he:

1) Acquires good personal habits and an understanding of personal motivations.

2) Keeps abreast of technological development by taking advantage of post-graduation educational opportunities.

3) Appreciates the role of engineering in the light of its responsibility to humanity generally.

4) Individually supports the efforts of industry, professional societies and the schools in their efforts to train more technicians.

George A. Sievers, industrial psychologist of the Industrial Engineering Institute, stressed the importance of being able to complete a job — not just start it — and the need for engineers to be conscious of their responsibility in cooperating with others. "Calculus and mechanics may be prime requisites," he said, "but the engineer cannot do anything unless he knows how to work with people — his boss, his associates and the people working under him."

Education has a partial responsibility in developing this philosophy, Dr. Carl W. Condit, assistant professor of English and humanities at Northwestern, told the group of some 300 engineering executives and technical educators. "We know that specialization, as exact and thorough as it can be, is a necessity in the profession of engineering," he said. "Yet no good specialist with the qualities of leadership in industry and technology will result from narrow specialized training."

AUTOMATIC OIL HEATING TO INCREASE IN '53

T. A. CRAWFORD, president of the Oil-Heat Institute of America, Inc., has announced that recent market studies indicate a 5 to 8 percent increase in 1953 over 1952 of automatic oil heating equipment.

Final reports for December installations had not been completed but the estimate for 1952 is 1,520,000 oil burners, boiler-burner and furnace-burner units, he said. In the commercial-industrial field 45,000 burners were installed — an increase of 3 to 5 percent over the previous year.

RESEARCH ON COAL BURNING INTENSIFIED BY BCR

AT ITS ANNUAL BUDGET meeting in Pittsburgh, the board of directors of Bituminous Coal Research, Inc., authorized the operation of an industry-research laboratory.

The BCR board instructed the officers to lease a building in Columbus, Ohio, to house the Columbus staff of the organization and provide facilities for design, development, and pilot plant testing of equipment and processes being investigated un-

Give to the 1953 RED CROSS FUND!

der BCR's general research program.

Dr. A. A. Potter, president of the national research agency of the bituminous coal industry, said that the board outlined four major divisions of research effort for the coal industry's cooperative program during 1953. Research will be conducted to increase user satisfaction in the residential and agricultural, commercial and small industrial, general industrial (including utilities), and gasification, carbonization, and chemicals from coal markets. Research on coal burning equipment for residential, agricultural, commercial, and small industrial uses will be intensified.

PREDICTS 2 MILLION ROOM UNITS IN '57

ANNUAL SALES OF single room air conditioners will be close to 2 million units in 1957 with the million mark being passed in 1955, according to Herbert L. Laube, president of the Remington Corp. and chairman of the room air conditioning section of the Air Conditioning and Refrigerating Machinery Association, at a meeting of the section held last month. "In 1955 alone we can expect sales of more than a million units at a manufacturers' value of about $200 million, which equals the total volume of the last seven years," he said.

Mr. Laube said his forecast was based on figures gathered by his company's air conditioning division.

Retail sales for 1952 of 400,000 units will rise to 590,000 for 1953, he said. For 1954 he predicts sales of 805,000 units, with a total of 1,045,000 in 1955 and 1,450,000 in 1956.

A major industry problem is to educate retailers and consumers to the fact that — unlike refrigerators, dishwashers and other appliances — the air conditioning unit suitable for one room isn't necessarily the one to do the same job in another room, it was brought out at the meeting.

There are eight general factors which can cause variation of as much as 600 percent in the room area which a particular unit can serve adequately.

A year or two of flooding the market with substandard equipment, improperly sold, can do irreparable harm and manufacturers should feel it their duty to do everything possible to prevent it, Mr. Laube said.

"QUOTE"

"I would plead with you to feel a real sense of partnership with the press of your industry or profession, and to be an *active* partner. It is your businesspaper, serving your interests; it is your responsibility to help it do the job well.

"How? By forthrightly sharing good editorial fodder. By being *constructively* critical of editorial objectives and content — the pat on the back as well as the kick in the pants. By refraining from effort to coerce editorial opinion, or trying to get away with puffs and something for free in the way of publicity. By a host of large or small things you can do to show that you have pride in the press that serves your business, and sincere desire to help it do a better and always better job." — *from a talk by William K. Beard, Jr., president, Associated Business Publications, at the annual conference of the Society for Advancement of Management.*

'52 CONSTRUCTION AWARDS BROKE ALL RECORDS

CONSTRUCTION CONTRACT awards in the 37 states east of the Rockies in 1952 broke all existing building records, topping the previous all-time high set in 1951, according to F. W. Dodge Corp.

The 1952 total for the 37 states was $16,774,936,000 or 6 percent greater than the 1951 figure. Contributing significantly to the overall total was the year end heavy engineering figure of $3,412,368,000, which was up 25 percent over 1951's comparative total.

Residential awards for 1952 totaled $6,667,504,000 or 7 percent higher than in 1951. Nonresidential awards were $6,695,064,000, down 2 percent from 1951.

In December, total construction awards were $1,467,384,000 or 18 percent more than November and 19 percent more than December 1951. Nonresidential awards were $709,100,000, up 54 percent over November and up 20 percent over December 1951. Residential at $438,580,000 was 17 percent less than November but 27 percent more than December 1951. Heavy engineering (public works and utilities) at $319,704,000 was 23 percent more than November and 8 percent above December 1951.

EVALUATE PLASTIC PIPE FOR WATER TRANSMISSION

THE RESEARCH evaluation study on extruded thermoplastic pipe being conducted by the National Sanitation Foundation, whose headquarters are at the University of Michigan's school of public health in Ann Arbor, has entered its second year of operation, according to Walter D. Tiedeman, director of the NSF testing laboratory.

This project, sponsored by the Society of the Plastics Industry, is to evaluate the non-toxicity of plastic pipe in the underground transmission of water. Plastics raw materials now undergoing tests include polyethylene, polystyrene, cellulose acetate butyrate, and copolymers of polyvinyl chloride.

SEES WIDER USE OF AUTOMATIC CONTROLS

ONE OF THE significant industrial trends during 1952 was the increased use by industry of more and more instrumentation and automatic control equipment to help meet expanded production goals in face of a tight labor supply. This continued investment in industrial instrumentation in 1952 showed a 10 percent rise over 1951 and represented many new applications for both new and old instruments.

All indications are that the trend toward wider use of instruments and controls will continue and will be a great stimulant to greater volumes of business for the instrument industry, according to Henry F. Dever, president of the Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

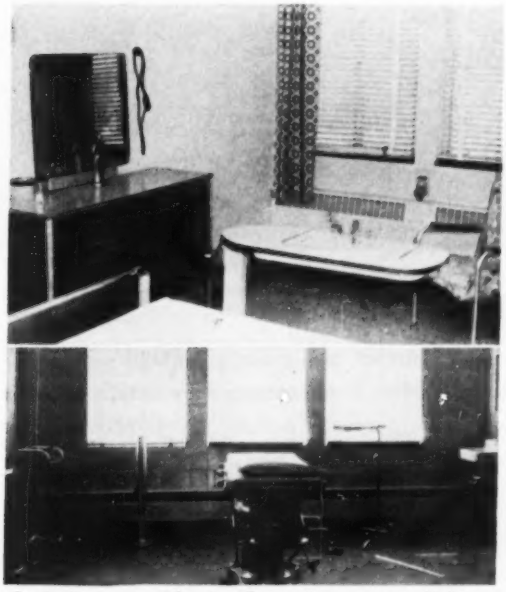
Reporting on the growth of automatic operation in industry, Mr. Dever pointed out that rates of expenditures for measuring and control instruments alone have increased twice as fast (in the last 15 years) as capital expenditures as a whole. Measuring and control instruments, he explained, provide the best index available for determining how far "automation" has gone.

"Mile High" Warm as Toast

Santa Anita Hospital, Lake Arrowhead, California. Built 1951. Operated by the Sisters of St. Joseph. Architect: Roland E. Coate, F.A.I.A., San Marino. Consulting Engineers: Hilburg, Byler & Hengstler, Los Angeles. Heating Contractor: Hansen Plumbing Co., San Bernardino.

Santa Anita Hospital, high in the San Bernardino Mountains, has forced hot water Webster Tru-Perimeter Heating

Comfort is one of the principal advantages of Webster Tru-Perimeter Heating in this new hospital. There are no cold walls to reduce body temperatures because Webster Walvector spreads the heat along every outside wall.



Semi-private room (above) and operating room use Webster Walvector wall-to-wall.

Right, X-ray Department is comfortably heated despite large window areas with Webster Walvector.

Webster Walvector, arranged for perimeter heating, contributes to economy of first cost. It eliminates exposed piping. Installation is easy. Webster Walvector uses sturdy aluminum fins on copper tubing. It's rapidly warmed. It is also possible to reduce heating quickly when occupancy is ended.

You can use Webster Walvector in new buildings or modernization . . . as individual convectors or arranged for perimeter heating. Complete technical data is available in Bulletin B-1551. Get in touch with your Webster Representative or write us.

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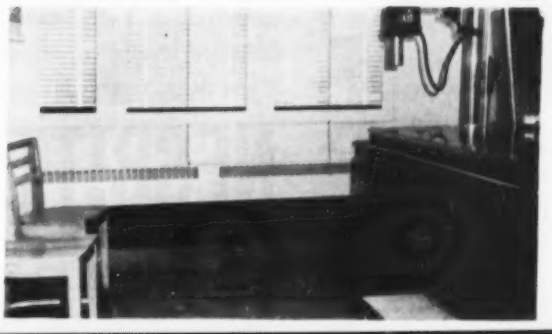
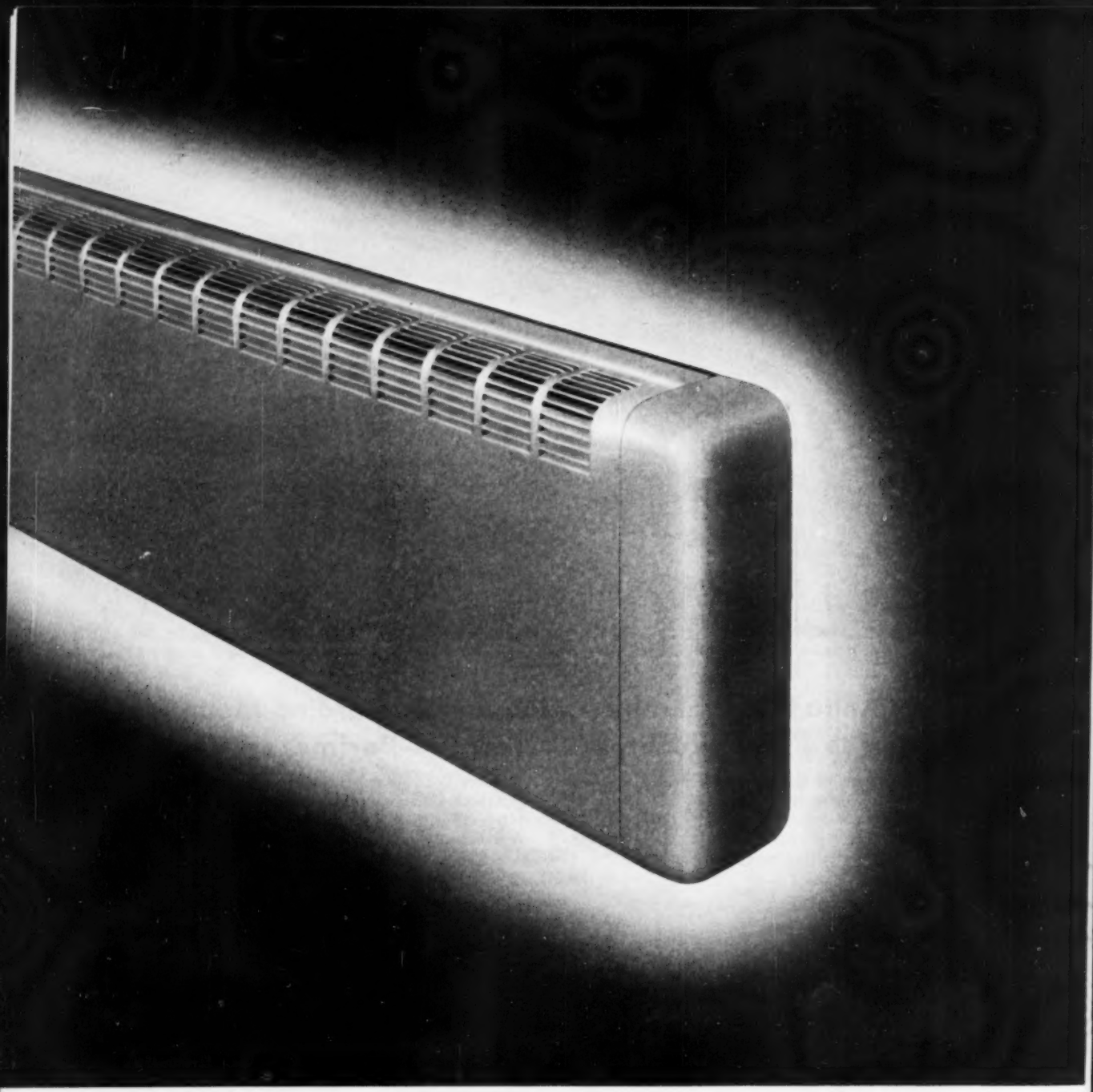
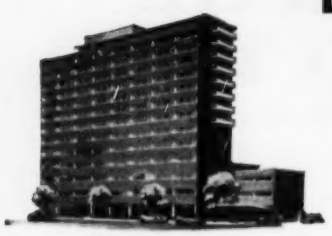




DESIGNED FOR MODERN HEATING



Sill-line will heat the New Pavilion, Jefferson Hospital, Philadelphia, Pa.

Vincent G. Kling, Architect
A. E. D'Ambly, Engineer
W. M. Anderson Co., Htg. Contractor

Nesbitt Sill-line offers you all the benefits of high-capacity wall-fin radiation in the first enclosure expressly styled to harmonize with contemporary building design. Here's quick, uniform, under-the-window perimeter heating that provides economy of operation, ease of installation, and wide flexibility; *plus* an entirely new concept of enclosure styling so desirable for today's institutional and commercial buildings. If you desire further information on this new product, send for Nesbitt Publication 271.

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"OPEN FOR DISCUSSION"

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to participate. Address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

ENDORSES VIEWS GIVEN IN TWO RECENT ARTICLES

C. T. BAKER'S STORY in the December HPAC on compressed air troubles and their cures presents a lot of good horse-sense in a compact package.

In one part, Mr. Baker mentions that the demand for compressed air had increased because of additions of pneumatic hoists, drills, hammers, etc. The piping had hardly been of adequate capacity originally, and pressure loss tests resulted in new piping of increased size which insured maintenance of adequate pressure at points where it was needed.

This brought to my mind several similar experiences of the past which disclosed that various sized air receivers or storage tanks serve a most useful function and can be used sometimes to cure sick air piping.

In many industrial plants, the usage of compressed air (drills, hammers, hoists, etc.) is either intermittent or fluctuating. The result is wide fluctuations of flow in the piping and marked fluctuations in pressure and volume at outlets.

The use of receivers to provide a reservoir of compressed air at or near points of usage not only insures ample volume and pressure, but smooths out the flow in supply mains and branches. Tanks of various sizes and suitable for compressed air service make excellent receivers for such purposes.

I also thought that Angus M. Brown's article about piping for industrial vacuum cleaning was well done and timely. I do not recall seeing much on this subject previously.

Mr. Brown's concluding remarks concerning the desirability of using 90 deg pipe bends for turns and offset pipe bends for directional changes can be endorsed from experience. Bending radii of 10 times pipe diameters (as suggested by Mr. Brown), are ideal when space permits. However, the use of bending radii as small as five or even four times pipe diameters (if space permits no larger) still offers decided advantages and is preferable to fittings.

The article does not mention the suspension of vacuum piping. Horizontal runs should be supported adequately to prevent sags in the piping. Sags are, in effect, pockets — and preferably should be avoided.—G. W. HAUCK, Manager, Engineering Sales, Crane Company. Member of HPAC's Board of Consulting and Contributing Editors.

REPLY BY AUTHOR — I appreciate very much Mr. Hauck's comments.

He is certainly correct in his statement concerning the desirability of the use of compressed air receivers to provide a reservoir at or near points of usage.

Many years ago, I saw this plan carried out in the operation of a very large stone quarry where many air drills were supplied from one central power station in which air compressors were installed to provide compressed air for the entire quarry.

As a matter of fact, the compressed air piping system, as it was originally installed in this development, would never have been capable of providing satisfactory operation of the innumerable air tools used, most of which had to operate around the clock six days a week.—C. T. BAKER, Consulting Engineer.

SUPPLYING AIR THROUGH LOUVERED CEILING PANELS

WM. O. HUEBNER'S comments in the January HPAC on his experience with supplying high rates of air through louvered panels are very interesting. There are usually, of course, several solutions to any one problem. In answering our particular problem, however, we felt that we found the most practical solution in the use of the equally spaced perforated tubes located above the relatively small louvered panel, as described in our article in the November HPAC. But again we wish to emphasize that this conclusion applied only to the room we were working with.

We agree with Mr. Huebner that one-sided delivery is not peculiar to rooms with louvered ceilings — that this phenomenon is caused by faulty design or application and not by the ceiling construction.

He suggests that one way to supply high rates of air through a louvered ceiling, without causing drafts or one-sided air flow, is to use several equally spaced diffusers when the available space above the ceiling is not high enough to allow a single centrally located diffuser to spread the supply stream sufficiently. While this method may work very well, we would like to point out that considerable care should be taken to make sure that the "throws" from the diffusers do not meet and thus cause downdrafts.—R. V. MARTELLI and H. O. SCARLETT, Mechanical Div., Construction Engineering. The Detroit Edison Co.

PRESSURIZING HIGH TEMPERATURE WATER SYSTEMS

THE ARTICLE BY J. R. Kell, on Pressurizing HPHW Systems, published in the February HPAC is quite interesting.

I would like to comment that this name, HPHW systems, is a term which I believe is generally not used in this country. We refer to such systems simply as high temperature water systems.

"Pressurization of heating systems by nitrogen appears to be advantageous", says the introductory paragraph of Mr. Kell's article. I do not feel, however, that any advantage is reached by using either air or nitrogen for pressurizing.

The systems shown by Mr. Kell in Figs. 1 and 2 of his article have been very well known for many years and have been tried long before pressurizing with steam was developed. The idea of using the steam space of a boiler or an expansion vessel as expansion space was the content of the basic patent which made possible the development of high temperature water systems all over the world.

The return to any devices — or any system using artificial pressurization with compressed air or nitro-

gen — is, in my opinion, a step backward, since even pressurizing with the practically inert gas nitrogen introduces unnecessary new sources of hazards.

Modern systems take utmost care to eliminate any traces of gases, such as carbon dioxide or oxygen, from the minute quantities of make-up water required for these types of systems.

Mr. Kell supports my views and gives in Figs. 7 and 8 of his article a clear justification of why it is not advisable to use this method. The "breathing" of air into the system will, after a few years, produce considerable corrosion and shorten the life of the system. Generally, it takes more than one year to develop, but in a time interval of three to six years — depending on the number of heating and cooling cycles — the bad effects of this method will be clearly shown.

I can only see disadvantages and no advantages using this approach to the problem.—PAUL L. GEIRINGER, Chief Engineer, American Hydrotherm Corp.

[Editor's note: In Table 2 of Mr. Kell's article, the second value in the third column should be 0.005368.]

RETURNING CONDENSATE FROM GROUP OF BUILDINGS

I WOULD LIKE TO comment on a recent article in HPAC, which article was written in answer to a reader who asked about returning condensate from a group of buildings.

This article stated that the present buildings have a vacuum heating system, but it did not state whether this system operates under 4 to 8 in. vacuum or whether it is an extremely high vacuum system operating around 20 to 24 in. This would have considerable bearing on this case as to the proper suggestion for returning the condensate from the new building. If the original buildings are operating under high vacuum, then, of course, the returns must definitely be returned by an individual vacuum pump in the new building through a separate discharge line clear back to the boiler room. We would, therefore, not advise dumping the return in to the return main of the high vacuum system.

On the other hand, if the original buildings are operating on a low vacuum heating system in ranges of approximately 4 to 8 in., then we would assume that the steam pressure on the original buildings is also approximately 2 lb pressure — the same as in the new building — and we see no reason why the condensate cannot return back in the same return line providing the system is properly trapped with thermostatic as well as float and thermostatic traps between the steam and the supply in the new building. If the new building is quite isolated from the other buildings at a distance, then we would definitely recommend that the returns be returned by a vacuum pump separately in its own discharge line back to the boiler room and not tied in with the original system at all.

It is naturally difficult to make the perfect recommendation without actually seeing the plans to determine elevations of the return lines in the new building in relation to the elevations of the lines of the other buildings, as well as the plan view.

If the elevation of the new building is such that the condensate can drain by gravity into the return lines of the original systems, then we see no objection to this since both jobs would be operating on approximately the same steam pressure and if properly trapped, the system should function very satisfactorily. On the other hand if the system is at a lower elevation, then, of course, the condensate will have to be pumped and a vacuum heating pump should be used. The discharge from this vacuum pump should either discharge all the way to the boiler in the individual line or tie in to a discharge line on the other vacuum pump. This would, of course, depend on the location of the other vacuum pump. By no means, however, should the vacuum pump in the new building discharge into the vacuum pump on the other system.

The condensation from the high pressure line ahead of the high pressure reducing valve in the new building should actually be handled by an individual high pressure return line back to a boiler feed surge tank if the building is so designed with that type of system. However, if it is considered too expensive to run an individual high pressure return line back to the surge tank in the boiler room, then it is feasible to double trap the high pressure return condensation through a small receiver with a float trap between the high pressure steam line and this receiver and a float and thermostatic trap between this receiver and the vacuum return line into the vacuum heating pump in the new building, or into the return line on the original system if the new building is above the original system. This little receiver then, of course, is vented into the 2 lb low pressure steam line of the new building so that the hot condensate can re-flash into steam in that system.

This is basically what the article suggested, except that I have recommended the proper types of traps to be used. In conclusion, I believe that if a tank with a float operated valve in the bottom of it for the purpose of discharging the vacuum pump in the new building is used, that this would just be merely a gadget which would create a further maintenance problem. I believe, therefore, that it would be worthwhile to run an individual line from the discharge of the vacuum pump back to the boiler even though that would be a little more costly to do. The discharge pressure of the vacuum heating pump then would, of course, be specified to handle the special requirement to overcome friction loss in that line and to also cover the static head in the boiler room up to the surge tank. —DICK W. WHITTINGTON, President, Whittington Pump & Engineering Corp.

"QUOTE"

"In our study of building design, we are becoming more and more conscious that further attention should be given to the outside walls of the building. Since the heating load in winter and the cooling load in summer, which must be designed for, are controlled almost entirely by the passage of heat through the walls, substantial operating economies can result if these walls are more efficient as heat insulators."—*Charles A. Peters, in a talk on innovations in new government buildings given before a conference of building owners and managers and reported in Skyscraper Management, published by the National Association of Building Owners and Managers.*

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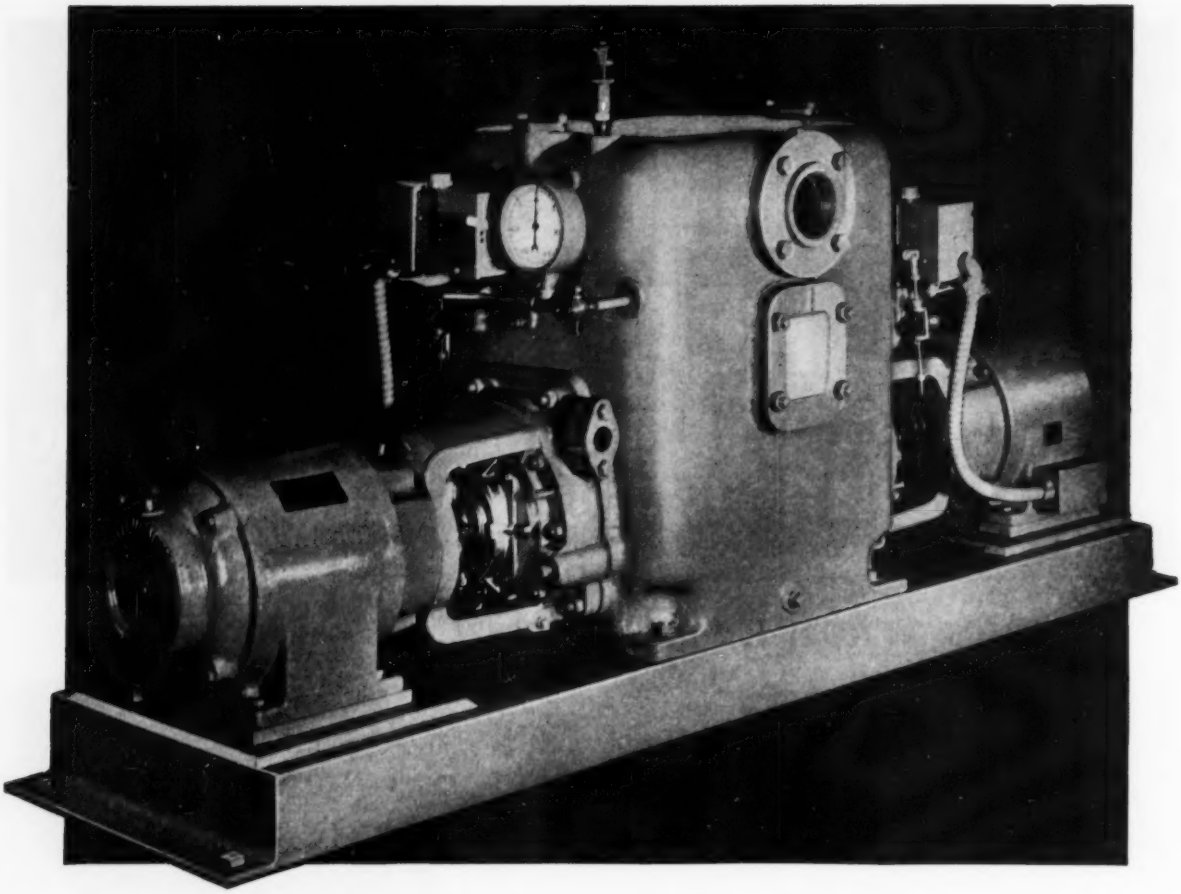

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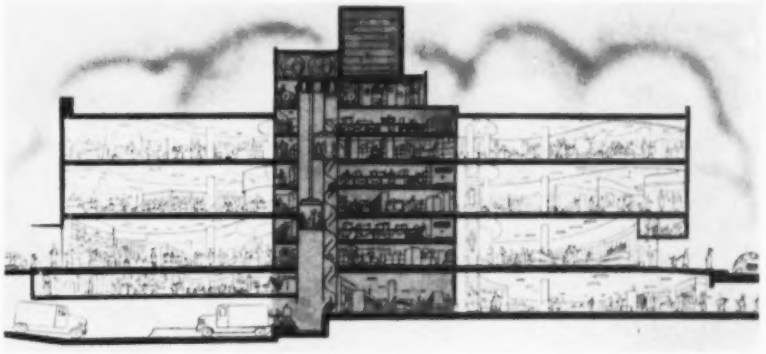
THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

THE MAY DEPARTMENT store company — operating as Famous-Barr Co. in St. Louis — has pioneered in establishing suburban retail stores in that area. Its first store of this type — in Clayton, a western suburb of St. Louis — was opened to the public August 1946. The second store was opened August 1950 at Kingshighway and Chippewa, in southwest St. Louis. A third store for north St. Louis is in the formative stage.

Famous-Barr installed air conditioning in its downtown store in 1939; it was the first in St. Louis to install air conditioning in all departments. Air conditioning was a "must" in the suburban store, for, as Fred Z. Saloman, general manager, has stated, "I wouldn't think of building a department store without air conditioning."

FAMOUS-BARR "WOULDN'T THINK of building a department store without air conditioning." Here's an "architect's-eye view" of the air conditioned Southtown suburban store



"MAGIC CORE" inaugurated by Famous-Barr facilitates handling of merchandise in the Southtown store. Much of the air conditioning and electrical equipment is located within the "magic core" space, which is shown shaded here

SUBURBAN STORES

. . . . . need air conditioning — just as any store does! Here's how Famous-Barr's novel Southtown store in St. Louis, featuring the "magic core" idea, is air conditioned

By A. G. Hillen
Branch Manager, Carrier Corp.

Incorporates Latest in "Retail Engineering"

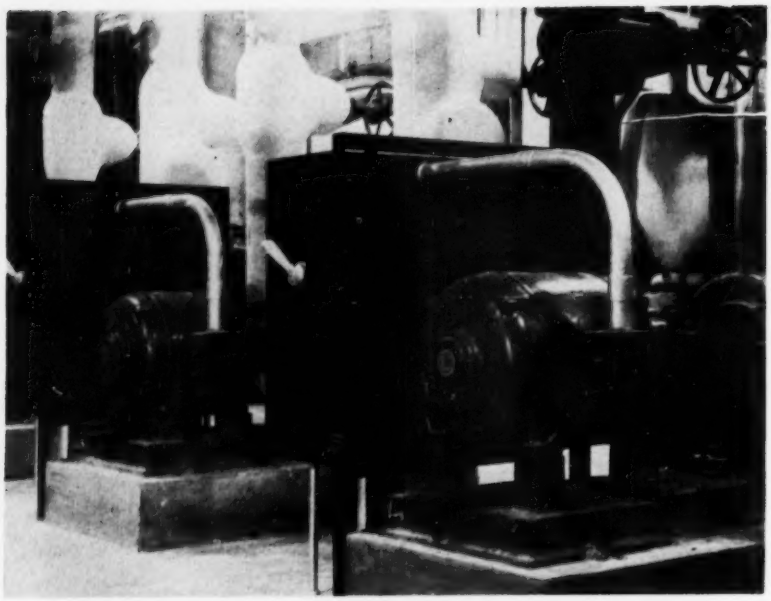
The development at Kingshighway and Chippewa is known as the Southtown store and incorporates the latest designs in "retail engineering." The architect for this store was P. John Hoener, of St. Louis, with Fred Rundall, store architect for the May company, coordinating. John Falvey designed the mechanical equipment. The general contractor was the Westlake Construction Co. The heating and piping contractor was the Eichler Co., and the ventilating contractor was the H. A. Grossmann Co.

The selling area comprises a portion of the basement, the first, second and third floors — a total area of 190,730 sq ft, which is made up of 53,370 sq ft each for the first, second and third floors, and the basement selling space of 30,620 sq ft. In the north half of the basement are the public and employee cafeterias and dining rooms, employee locker rooms, shipping and receiving, executive offices, and training classrooms. This portion of the building has a sub-basement in which is located the mechanical equipment and service shops.

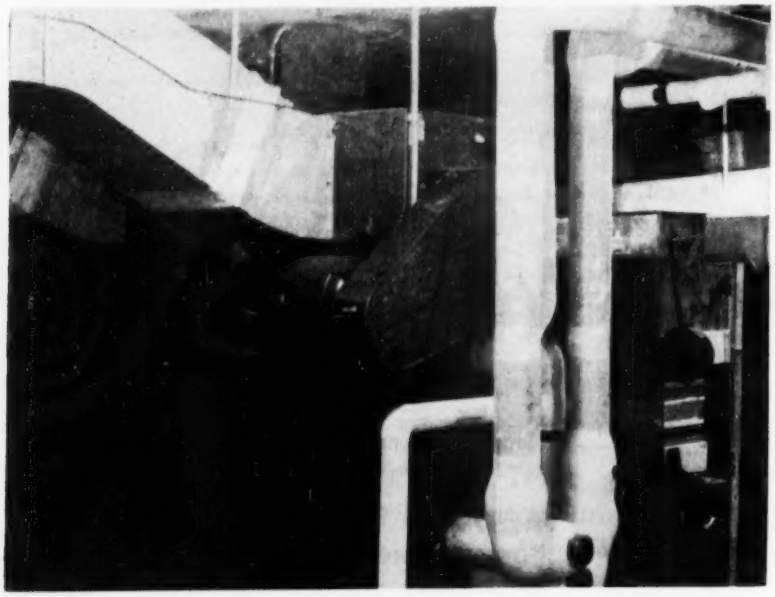
"Magic Core" Facilitates Handling of Merchandise

In the center of the store on the first, second and third floors is an area partitioned off from the selling space which is called the "magic core". This area is 5700 sq ft on each floor. The floor to floor ceiling height of the first and second floors was designed to be 19 ft, 8 in. so that the "magic core" could be double-decked, resulting in a 9 ft ceiling height in this space. The ceiling height for the third floor is 12 ft, so in order to double-deck the "magic core" for the third floor, the upper area extends through the roof as a penthouse. The "magic core" area does not extend into the basement selling space.

The idea of the "magic core" was



AIR CONDITIONING PUMPS, with their motors and control equipment, which are located in the machinery space along with the refrigerating compressors, boilers, etc.



ONE OF THE AIR CONDITIONING units which serves the store. Chilled water or heated water is furnished this and the other units for cooling or heating, depending upon the season

inaugurated by Famous-Barr to facilitate the handling of merchandise in the store. All incoming merchandise is trucked from the street level down a ramp to the receiving dock, where it is then marked and transported by hand truck to the basement area under the "magic core". A freight elevator is available to stock the merchandise on one of the levels of the "magic core" on the floor on which the merchandise is to be sold, so that a sales representative has only to walk to the "magic core" area to replace articles out of stock on the selling floor.

Not only does the "magic core" serve as a miniature warehouse or stockroom, but the public restrooms and the air handling equipment for the air conditioning of the center or interior zone of the building are also located in it.

Designing Conditioning For Department Stores

Designing an air conditioning system for a department store presents the engineer an opportunity to use his ingenuity to the utmost. Modern design of good lighting involves electrical loads of 3 to 6 watts per sq ft. At Southtown, the electrical load is 4 watts per sq ft in the basement, 5.5 watts on the first floor, 4 watts on the second floor, and 3.5 watts per sq ft on the third floor.

The balance of the internal heat gain is represented by people. The Southtown store is a high volume store; hence, the people per sq ft was figured liberally. The calculations were based on 15 sq ft per person in the basement, 25 sq ft per person on the first floor, 50 sq ft per person on the second floor, and 75 sq ft per person on the third floor. Since this store is a windowless building, the other main source of heat gain is the outside air for ventilation.

In addition to the general selling space, the employee cafeteria, public restaurants, meeting rooms, executive offices, busheling room, beauty parlor, and the employee locker and restrooms are air conditioned. Exhaust systems are required for the public and employee restrooms, kitchen, beauty parlor, mechanical equipment room and busheling room [where garments are altered]. Air conditioning and ventilating such spaces presents individual problems to the designing engineer.

To prevent cooking odors from entering the dining room — and also to keep the kitchen temperature from becoming unbearable — all the air supplied by the air conditioning system serving the restaurant is outside air and is exhausted through the kitchen general exhaust system and range hoods. Control of temperature in the dining room is obtained by steam reheat control.

In the beauty parlor, the volume of exhaust air exceeds the quantity of outside air supplied by the air conditioning system in order that there will be an infiltration from the store through the entrance to the beauty parlor, preventing odors from getting

out into the store proper. Exhaust openings in the beauty parlor are strategically placed to removed heat and odors.

Air Conditioning Equipment Is in "Magic Core"

The units for air conditioning the interior zone of the store are located on the upper level of the "magic core"; there are two units per floor. The supply duct is above the false ceiling in the store with sidewall outlets in the wall discharging toward the outside wall. Return air is taken through the entrances from the store to the "magic core". Since the light load and the people load in the "magic core" are relatively low, the return air from the selling space passing through this area keeps the temperature within the comfort zone. Outside air for ventilation is taken through a louver and screen in the outside wall for these units. In winter, the air is preheated to 50 deg.

Each of these air conditioning units is equipped with a six-row water coil for cooling and dehumidifying and this coil serves as a heating coil in winter to add whatever heat is necessary to maintain comfortable conditions in the store. A hot water convertor in the basement connected into the piping system heats the same quantity of water as is circulated in the summer.

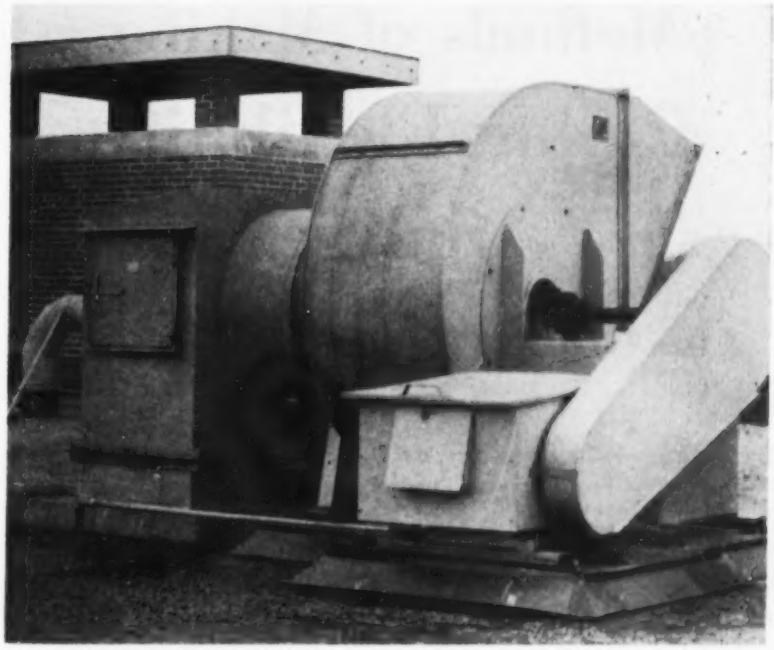
The units supplying air for the exterior zone of the building are in the apparatus rooms over the show windows at two corners of the building. These units also have six-row water coils for cooling and dehumidifying, and in winter for tempering, with the preheaters heating the outside air to 50 deg. All the units for the third floor are in the upper level of the third floor "magic core", which forms a penthouse, and have the same arrangement for cooling, dehumidifying and heating as outlined above. Considerable thought and study was given to the apparatus rooms to keep their size to a minimum, to locate them in places for maximum efficiency, and to give maximum usable area for the operation of the store.

Two 450 Ton Centrifugals Supply Chilled Water

Two 450 ton centrifugal refrigerating machines in the basement chill water for summer cooling and dehumidifying. On peak outside temperature days when the store is crowded, both machines are used. On mild days, one machine will carry the load. Duplicate chilled water and condenser water pumps were installed.

The outside air intakes have minimum and maximum outside air dampers; the minimum damper opens when the fan starts to allow the entrance of sufficient air for ventilation. During the intermediate season, the maximum outside air dampers can be opened to supply 100 percent of the fan supply from the outside. A distinct advantage in saving in operating cost for the refrigeration plant is realized by supplying all outside air on mild temperature days.

Since this store is a windowless building, the outside air supplied to the store is exhausted by three 72 in. propeller exhaust fans having a capacity of 40,000 cfm each, which are located in the penthouse. A shaft which extends from the fans to the basement receives the air from all the floors and does a perfect job of exhausting. Three fans are used so that the correct amount of air can be exhausted with varying values of the maximum outside air temperature.



AN EXHAUST FAN on the roof of the Southtown store, drawing air from the restaurant. There are also smaller exhaust units on the roof for washrooms. Not shown is a large duct insulated with 4 in. of cork installed on the roof, which conveys conditioned air. Running it on the roof simplified the layout and conserved space within the building

Exhaust Air Keeps Parking Area Tunnel Cool

Customer parking is available adjacent to the store and also in an extensive area across the street. For the convenience of customers parking across the street, there is a tunnel under Chippewa from the parking area to the basement selling space. Exhaust air from the store keeps this tunnel cool in summer and prevents condensation on the walls, floor and ceiling. The tunnel entrance is heated in the winter.

The entrances to the store are heated by units which throw a blanket of warm air down at the doors on the store side to kill the chilling effect.

[Photos of equipment shown here courtesy of the Century Electric Co.]

* * * *

• Construction contract awards in the 37 states east of the Rockies in January were $1,075,868,000, 27 percent less than in December but 19 percent more than January 1952, according to F. W. Dodge Corp.

Methods of Making Piping Flexibility Analyses

The Grapho-Analytical Method

By Arthur McCutchan and W. P. Gregory
Chief Product Engineer and Product Engineer, respectively
Tube Turns, Inc.

THIS ARTICLE IS presented as an addition to the series initiated in the June 1946 issue (1)[1] of Heating, Piping & Air Conditioning. In that opening article, it was suggested that each proponent of the various methods of solving piping flexibility problems submit solutions of two (more or less) typical problems accompanied by a brief description of the application of his preferred method. The two problems suggested were a single plane Z-bend problem, Fig. 2, and a three-dimensional problem described by Professor Hovgaard (2) in his 1935 paper and again in 1937, Fig. 3. The *Grapho-Analytical Method* appears in its entirety in the Piping Handbook (3), applicable portions of which are reproduced in this article.

In solving flexibility problems by this method, it is first assumed that the principle of superposition applies; that is, the thrusts and bending moments existing at an anchor point may be transposed to each component part of the system involved and an algebraic summation made of the deflections of the component parts produced by such transposed forces and moments and by the cumulative rotations of the elements between each component part and the anchored end of the piping. The method by which this is accomplished is best explained by means of the two sample problems.

[1]Numbers in parentheses refer to the bibliography.

The opinions expressed in this article are those of the authors and do not necessarily represent the views of Tube Turns, Inc.

Before entering into a discussion of the problems, however, it might be well to consider some of the advantages and disadvantages of the method.

Advantages, Disadvantages of the Method

The principal advantage — and one especially appreciated by engineers — is that the composite problem is reduced to a series of simple solutions which show exactly what is happening to each component of the line. The forces, moments and stresses may be computed at any point in the system, thus giving the flexibility analyst complete information upon which he may base the proper location of closing joints, anchors and supports. The simple solutions mentioned are shown as "cases" in Fig. 1. Their application to the problems incorporating the principle of superposition is shown in the detailed solution of the Z-bend and Hovgaard problems. A more complete discussion is given in Reference (3).

A second distinct advantage of the grapho-analytical system is that the accuracy of the work may be checked by "Maxwell's law of reciprocity of displacement" before the final simultaneous equations are solved. A statement of Maxwell's law as applied to single plane problems is: "If a force F applied at a given point in direction X causes a displacement Δ at that point in the Y direction, then the same force F applied at that point in the Y direction causes the same displacement Δ in the X direction." Applied to the Z-bend problem, this shows that the coefficient of F_Y due to Δ_X is the same as the coefficient of F_X due to Δ_Y. Another check which will often reveal errors in arithmetic — the bane of engineers in general — is that the algebraic summation of the moment area diagram is equal to 0.

Probably the greatest advantage of the grapho-analytical method is that, once understood, it can be applied to the most complex piping systems with the same assurance with which it is applied to the simpler problems — the only difference being the amount of labor involved in computation. It is inevitable, however, that the amount of labor involved in any method will be more or less proportional to the accuracy sought. For application of the grapho-analytical method to multi-ended piping systems reference may be made to the work of Vinieratos and Zeno, Reference (4).

The principle disadvantage of the grapho-analytical method is that the computer must be able to visualize the rotations and deflections in order to carry it out, or at least to be able to follow a similar solution.

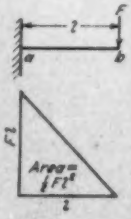
Some of the other better known methods have standardized calculation sheets by which the work of computation can be done by calculation groups without necessarily understanding the problem. Some efforts have been made to so standardize the grapho-analytical method but it seems to the present authors that by so doing, the first advantage mentioned (that of knowing what is happening at any point in the system) is lost, or is to some extent impaired.

In common with other methods, considerable additional effort is involved when the additional flexibility of the elbows or bends is taken into account. For many problems the square-corner approximations are found to be adequate. Their simplicity suggests that they always should be used as a guide in preliminary layouts. The square-corner solution involves only three relations, i.e., ψl — Case I, $\psi M\ 1/2\ l$ — Case II, and $\psi F\ 2/3\ l$ — Case III, in which ψ = area of the bending moment diagram between the element in question and the fixed end, and ψM and ψF = area of bending moments due to the moment and force, respectively, acting on the element. These three re-

Fig. 1—Elementary Cases
Sheet 1 of 4

CASE I. Fixed end of a cantilever rotated through an angle.

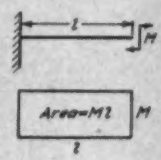
$\Delta_b = \psi_a l$ = deflection of the free end of a cantilever due to rotation of the fixed end.



CASE II. Straight cantilever acted on by a transverse force F at the free end.

$\psi_F = \frac{Fl^2}{2EI}$

$\Delta_F = \psi_F \frac{2}{3} l$ = deflection in direction of force.

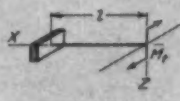


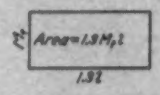
CASE III. Straight cantilever acted on by a moment M at the free end.

$\psi_M = \frac{Ml}{EI}$

$\Delta_M = \psi_M l$ = deflection along moment arm as shown.

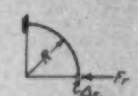
Fig. 1—Elementary Cases
Sheet 2 of 4

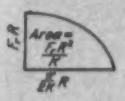




CASE IV. Straight cantilever acted on by a torsional moment M_t.

$\psi_{M_t} = 1.30 \frac{M_t l}{EI}$





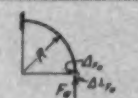
CASE V. Quarter bend fixed at one end and acted on by a radial force F_r in plane of bend.

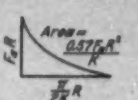
$\psi_{F_r} = \frac{F_r R^2}{KEI}$,

in which K is the rigidity multiplication factor.

$\Delta_{F_r} = \psi_{F_r} 0.7854R$ = deflection in direction of force F_r.

$\Delta\perp_{F_r} = \psi_{F_r} 0.50R$ = deflection perpendicular to direction of force F_r.





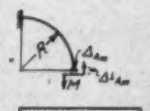
CASE VI. Quarter bend fixed at one end and acted on by an axial force F_a in plane of bend.

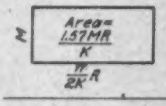
$\psi_{F_a} = \frac{0.5708 F_a R^2}{KEI}$

$\Delta_{F_a} = \psi_{F_a} 0.634R$ = deflection in direction of force F_a.

$\Delta\perp_{F_a} = \psi_{F_a} 0.876R$ = deflection perpendicular to direction of force F_a.

Fig. 1—Elementary Cases
Sheet 3 of 4



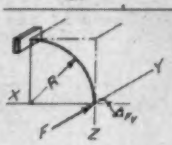


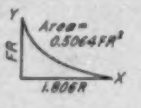
CASE VII. Quarter bend fixed at one end and acted on by a bending moment M in plane of bend.

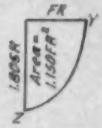
$\psi_M = \frac{1.5708 MR}{KEI}$

$\Delta_{M_M} = \psi_M 0.637R$ = deflection along moment arm as shown.

$\Delta\perp_{M_M} = \psi_M 0.363R$ = deflection perpendicular to moment arm as shown.







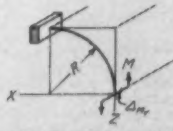
CASE VIII. Quarter bend fixed at one end and acted on by a force F perpendicular to plane of bend.

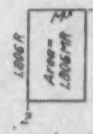
$\psi_{FT} = \frac{0.5064 FR^2}{EI}$; $\Delta_{F_{FT}} = \psi_{FT} 0.754R$ = deflection in direction of force (proportional to rotation in plane perpendicular to free end of bend).

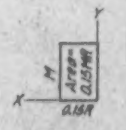
$\psi_{FI} = \frac{1.150 FR^2}{KEI}$; $\Delta_{F_{FB}} = \psi_{FB} 0.754R$ = deflection in direction of force (proportional to rotation in plane tangent to free end of bend).

$\Delta_{F_F} = \Delta_{F_{FT}} + \Delta_{F_{FB}} = \frac{1.2485 FR^3}{EI}$ = total deflection in direction of force.

Fig. 1—Elementary Cases
Sheet 4 of 4





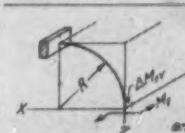


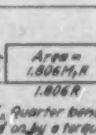
CASE IX. Quarter bend fixed at one end and acted on by a moment M in plane perpendicular to plane of bend.

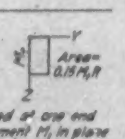
$\psi_{M_{MT}} = \frac{0.150 MR}{EI}$; $\Delta_{M_{MT}} = \psi_{M_{MT}} 0.695R$ = deflection to left along moment arm (proportional to rotation in plane perpendicular to free end of bend).

$\psi_{M_{MB}} = \frac{1.806 MR}{EI}$; $\Delta_{M_{MB}} = \psi_{M_{MB}} 0.695R$ = deflection to right along moment arm (proportional to rotation in plane tangent to free end of bend).

$\Delta_{M_M} = \psi_{M_{MB}} 0.637R = \frac{1.150 MR^2}{EI}$ = resultant deflection in terms of larger rotation.







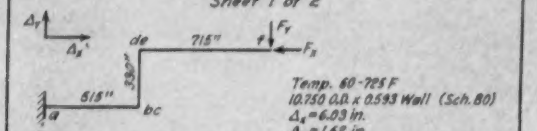
CASE X. Quarter bend fixed at one end and acted on by a torque moment M_t in plane perpendicular to free end of bend.

$\psi_{M_T} = \frac{1.806 M_t R}{EI}$; $\Delta_{M_{TT}} = \psi_{M_T} 0.306R$ = deflection to right perpendicular to plane of bend (proportional to rotation in plane perpendicular to free end of bend).

$\psi_{M_B} = \frac{0.150 M_t R}{EI}$; $\Delta_{M_{TB}} = \psi_{M_B} 0.306R$ = deflection to left perpendicular to plane of bend (proportional to rotation in plane tangent to free end of bend).

$\Delta_{M_T} = \psi_{M_T} 0.290R = \frac{0.5064 M_t R^2}{EI}$ = resultant deflection in terms of larger rotation.

Fig. 2 – Z-Bend Problem
Sheet 1 of 2

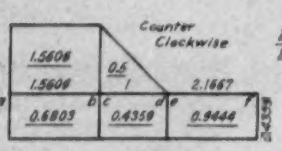


Temp. 60-725 F
10.750 O.D. x 0.593 Wall (Sch. 80)
Δ_x = 6.03 in.
Δ_y = 1.62 in.
I = 244.8 in.⁴
E = 25 x 10⁶ #/in.²
Divisor = 330

$\frac{715}{330} = 2.1667$

$\frac{515}{330} = 1.5606$

F_x IN X-Y PLANE



$\frac{\Sigma A}{\Sigma L} = \frac{1.5606 + 0.500 + 2.0606}{2.1667 + 1.0000 + 1.5606 + 4.7273} = 0.4359$

$EI\Delta_{xbc} = 0$

ψ_{ab} = 1.5606
−0.6803
0.8803

CASE III − $EI\Delta_{xbc} = \psi_m A_m l = 0.8803 \times 0.7803 = 0.6869\ F_x$ Up
CASE II − $EI\Delta_{xde} = \psi_b A_b l = 0.5 \times 0.6667 = 0.3333\ F_x$ Left
CASE I − $\psi_{ab} l = 0.8803 \times 1 = 0.8803\ F_x$ Left
CASE III − $\psi_m A_m l = 0.4359 \times 0.5 = 0.2179\ F_x$ Right
0.9957 F_x Left

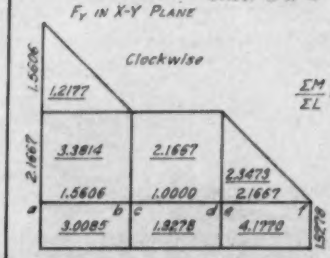
$EI\Delta_{ybc} = 0$
$EI\Delta_{yf} = 0$

ψ_{de} = 0.8803
0.5000
1.3803
−0.4359
0.9444

CASE I − $EI\Delta_{yf} = \psi_{de} l = 0.9444 \times 2.1667 = 2.0464\ F_y$ Up
CASE III − $\psi_m A_m l = 0.9444 \times 1.0834 = 1.0232\ F_y$ Down
1.0232 F_y Up

Fig. 2 – Z-Bend Problem
Sheet 2 of 2

F_y IN X-Y PLANE



$\frac{\Sigma M}{\Sigma L} = \frac{1.2177 + 3.3814 + 2.1667 + 2.3473 + 9.1131}{1.5606 + 1.0000 + 2.1667 + 4.7273} = 1.9278$

ψ_{ab} = 1.2177
3.3814
4.5991
−3.0085
1.5906

$EI\Delta_{xbc} = 0$
CASE II − $EI\Delta_{yde} = \psi_b A_b l = 1.2177 \times 1.0409 = 1.2679\ F_y$ Down
CASE III − $\psi_m A_m l = 0.3729 \times 0.7803 = 0.2910\ F_y$ Down
1.5589 F_y Down
CASE I − $EI\Delta_{xbc} = \psi_{ab} l = 1.5906 \times 1 = 1.5906\ F_y$ Right
$\psi_m A_m l = 0.2388 \times 0.5 = 0.1194\ F_y$ Right
1.7100 F_y Right

ψ_{de} 1.5906
2.1667
3.7573
−1.9278
1.8295

$EI\Delta_{ybc} = 0$
$EI\Delta_{xf} = 0$
CASE I − $EI\Delta_{yf} = \psi_{de} l = 1.8295 \times 2.1667 = 3.9639\ F_y$ Down
CASE II − $\psi_f A_f l = 2.3473 \times 1.4445 = 3.3907\ F_y$ Down
CASE III − $\psi_m A_m l = 4.1770 \times 1.0834 = 4.5254\ F_y$ Up
2.8292 F_y Down

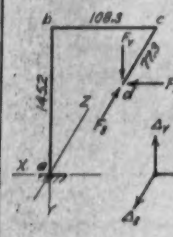
$\frac{EI\Delta_x}{(330)^3} = \frac{65 \times 10^6 \times 244.8 \times 6.03}{36 \times 10^6} = 1026.9 = 0.9957\ F_x$ Left −1.7100 F_y Right
0.6869 F_x Up +1.5585 F_y Down
1.0232 F_x Up +2.8292 F_y Down

$\frac{EI\Delta_y}{(330)^3} = \frac{25 \times 10^6 \times 244.8 \times 1.62}{36 \times 10^6} = 275.9 = -1.7101\ F_x$ Up +4.3877 F_y Down

$1026.9 = 0.9957\ F_x$ Left − 1.7100 F_y Right
$275.9 = -1.7101\ F_x$ Up + 4.3877 F_y Down

F_x = 3456.2 F_y = 1412.1

Fig. 3 – Hovgaard Problem
Sheet 1 of 5

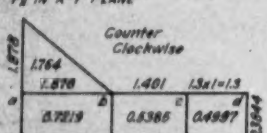


Temp. Range 0-850 F
Pipe Size 7.288 O.D. x 0.241 Wall
E = 24 x 10⁶ Psi
I = 33.14 in.⁴
Δ_x = 108.3 x 0.006083 = 0.6588"
Δ_y = 145.2 x 0.006083 = 0.8833"
Δ_z = 77.3 x 0.006083 = 0.4702"
Divisor = 77.3

$\frac{108.3}{77.3} = 1.401$

$\frac{145.2}{77.3} = 1.878$

F_z IN X-Y PLANE



$\frac{\Sigma A}{\Sigma L} = \frac{1.764}{1.878 + 1.401 + 1.300 + 4.579} = 0.3844$

ψ_a = 1.764
−0.7219
1.0421

CASE II − $EI\Delta_{zbc} = \psi_b A_b l = 1.764 \times 1.878 \times 0.667 = 2.209\ F_z$ Left
CASE III − $\psi_m A_m l = 0.7219 \times 1.878 \times 0.5 = 0.6779\ F_z$ Right
1.5311 F_z Left

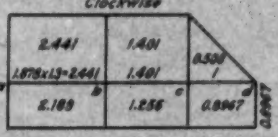
ψ_b = 1.0421
−0.6386
0.4035

$EI\Delta_{zbc} = 0$
$EI\Delta_{zf} = 0$
CASE I − $EI\Delta_{zf} = \psi_b l = 1.0421 \times 1.401 = 1.460\ F_z$ Up
CASE III − $\psi_m A_m l = 0.6386 \times 0.7905 = 0.5048\ F_z$ Down
0.9572 F_z Up

$EI\Delta_{xf} = 0$
$EI\Delta_{yf} = 0$

Fig. 3 – Hovgaard Problem
Sheet 2 of 5

F_x IN X-Z PLANE
Clockwise



$\frac{\Sigma A}{\Sigma L} = \frac{2.441 + 1.401 + 0.500}{2.441 + 1.401 + 1.000} = \frac{4.342}{4.842} = 0.8967$

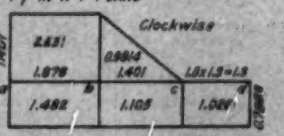
ψ_a = 2.441
−2.189
0.252

$EI\Delta_{xbc} = 0$
$EI\Delta_{xde} = 0$
$EI\Delta_{xf} = 0$
CASE I − $EI\Delta_{xbc} = \psi_a l = 0.252 \times 1.401 = 0.3531\ F_z$ Out
CASE III $\psi_m A_m l = 0.145 \times 1.401 \times 0.50 = 0.1016\ F_z$ Out
0.4515 F_z Out

ψ_b = 0.252
1.401
1.653
−1.256
0.397

CASE I − $EI\Delta_{xbf} = \psi_b l = 0.397 \times 1.00 = 0.3970\ F_z$ Left
CASE II − $\psi_f A_f l = 0.500 \times 1.00 \times 0.667 = 0.3330\ F_z$ Left
CASE III − $\psi_m A_m l = 0.8967 \times 1.00 \times 0.500 = 0.4486\ F_z$ Right
0.2816 F_z Left

F_y IN X-Y PLANE



$\frac{\Sigma A}{\Sigma L} = \frac{2.631 + 0.8814 + 1.878 + 1.401 + 1.300}{4.579} = \frac{3.6124}{4.579} = 0.7889$

CASE III − $EI\Delta_{ybc} = \psi_b A_b l = 1.149 \times 1.878 \times 0.500 = 1.079\ F_y$ Right
ψ_a = 2.631
−1.482
1.149

$EI\Delta_{yde} = 0$
$EI\Delta_{yf} = 0$
CASE I − $EI\Delta_{yf} = \psi_a l = 1.149 \times 1.401 = 1.610\ F_y$ Down
CASE II − $\psi_f A_f l = 0.8814 \times 0.667 \times 1.401 = 0.8170\ F_y$ Down
CASE III − $\psi_m A_m l = 1.105 \times 0.500 \times 1.401 = 0.7740\ F_y$ Up
1.753 F_y Down

ψ_b = 1.149
0.8814
2.1304
−1.1050
1.0254

$EI\Delta_{xbf} = 0$
$EI\Delta_{yf} = 0$

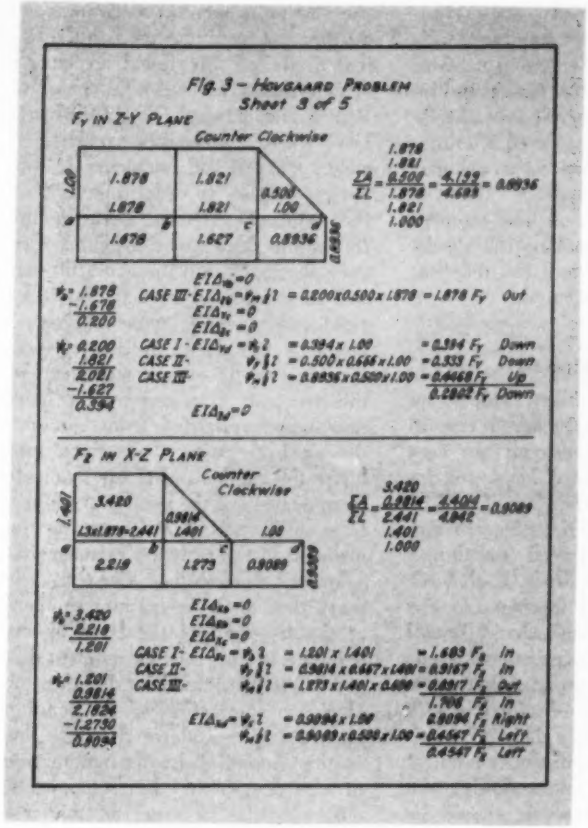


Fig. 3 – Hovgaard Problem
Sheet 3 of 5
F_Y in Z-Y Plane
Counter Clockwise
1.878
1.821
0.500
1.00
1.627
0.8936
$\frac{\Sigma A}{\Sigma L} = \frac{0.500}{4.699} = 0.8936$
$EI\Delta_{ra} = 0$
ψ_b 1.878 − 1.678 = 0.200
CASE III – $EI\Delta_{rb} = \psi_m \int 1 = 0.200 \times 0.500 \times 1.878 = 1.878\ F_Y$ Out
$EI\Delta_{rc} = 0$
$EI\Delta_{rd} = 0$
ψ_c 0.200 − 1.821 + 2.021 − 1.627 = 0.394
CASE I – $EI\Delta_{rd} = \psi_b \int 2 = 0.394 \times 1.00 = 0.394\ F_Y$ Down
CASE II – $\psi_b \int 2 = 0.500 \times 0.666 \times 1.00 = 0.333\ F_Y$ Down
CASE III – $\psi_m \int 2 = 0.8936 \times 0.500 \times 1.00 = 0.4468\ F_Y$ Up
$0.2862\ F_Y$ Down
$EI\Delta_{ra} = 0$
F_Z in X-Z Plane
Counter Clockwise
3.420
0.9814
1.401
1.00
2.219
1.273
0.9089
$\frac{\Sigma A}{\Sigma L} = \frac{0.9814}{2.441} = \frac{4.404}{4.842} = 0.9089$
$EI\Delta_{ra} = 0$
$EI\Delta_{rb} = 0$
$EI\Delta_{rc} = 0$
ψ_a 3.420 − 2.219 = 1.201
CASE I – $EI\Delta_{ra} = \psi_b \int 1 = 1.201 \times 1.401 = 1.683\ F_Z$ In
CASE II – $\psi_b \int 2 = 0.9814 \times 0.667 \times 1.401 = 0.9167\ F_Z$ In
ψ_c 1.201 + 0.9814 + 2.1624 − 1.2790 = 0.9094
CASE III – $\psi_m \int 1 = 1.273 \times 1.401 \times 0.500 = 0.8917\ F_Z$ Out
$1.708\ F_Z$ In
$EI\Delta_{rd} = \psi_c \int 1 = 0.9094 \times 1.00 = 0.9094\ F_Z$ Right
$\psi_m \int 2 = 0.9089 \times 0.500 \times 1.00 = 0.4547\ F_Z$ Left
$0.4547\ F_Z$ Left

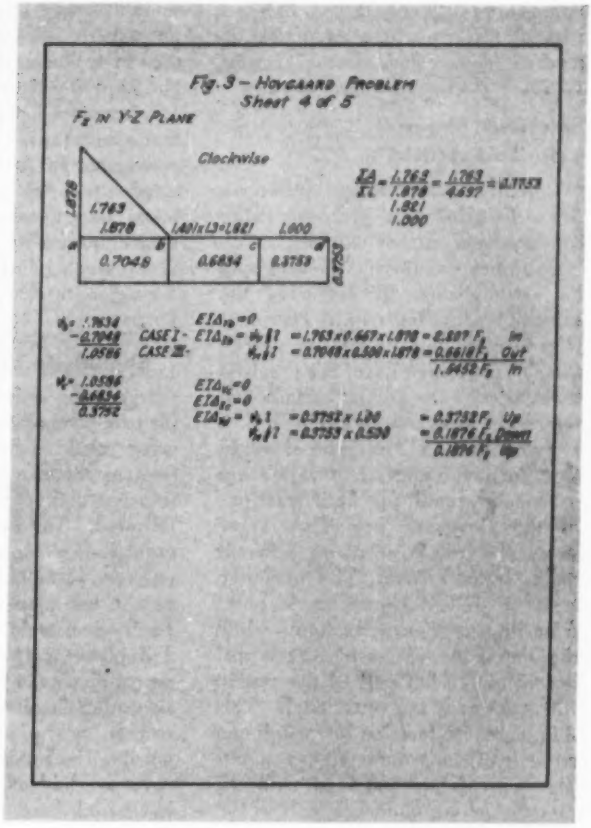


Fig. 3 – Hovgaard Problem
Sheet 4 of 5
F_Z in Y-Z Plane
Clockwise
1.878
1.763
1.821
1.000
0.7048
0.6834
0.3753
$\frac{\Sigma A}{\Sigma L} = \frac{1.763}{4.697} = 0.3753$
$EI\Delta_{ra} = 0$
ψ_a 1.763 − 0.7048 = 1.0586
CASE I – $EI\Delta_{ra} = \psi_b \int 1 = 1.763 \times 0.667 \times 1.878 = 2.207\ F_Z$ In
CASE III – $\psi_m \int 1 = 0.7048 \times 0.500 \times 1.878 = 0.6618\ F_Z$ Out
$1.5452\ F_Z$ In
$EI\Delta_{rc} = 0$
$EI\Delta_{rd} = 0$
ψ_c 1.0586 − 0.6834 = 0.3752
$EI\Delta_{rd} = \psi_c \int 1 = 0.3752 \times 1.00 = 0.3752\ F_Z$ Up
$\psi_m \int 2 = 0.3753 \times 0.500 = 0.1876\ F_Z$ Down
$0.1876\ F_Z$ Up

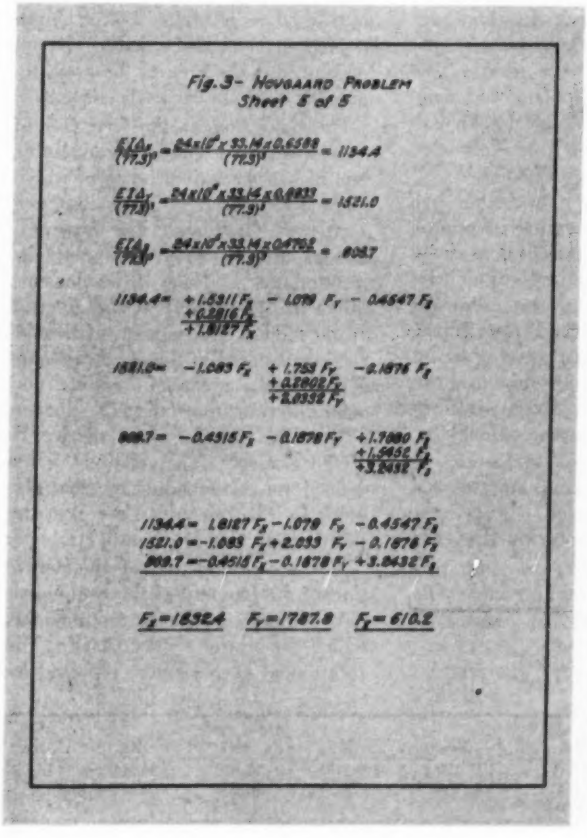


Fig. 3 – Hovgaard Problem
Sheet 5 of 5
$\frac{EI\Delta_a}{(77.5)^2} = \frac{24 \times 10^6 \times 33.14 \times 0.6588}{(77.5)^2} = 1134.4$
$\frac{EI\Delta_b}{(77.5)^2} = \frac{24 \times 10^6 \times 33.14 \times 0.8839}{(77.5)^2} = 1521.0$
$\frac{EI\Delta_c}{(77.5)^2} = \frac{24 \times 10^6 \times 33.14 \times 0.4702}{(77.5)^2} = 809.7$
$1134.4 = +1.5911\ F_X + 1.079\ F_Y + 0.4547\ F_Z$
$+0.2816\ F_X$
$+1.8127\ F_X$
$1521.0 = -1.083\ F_X + 1.753\ F_Y - 0.1876\ F_Z$
$+0.2808\ F_X$
$+2.8352\ F_Y$
$809.7 = -0.4515\ F_X - 0.1878\ F_Y + 1.7880\ F_Z$
$+1.5452\ F_Z$
$+3.2452\ F_Z$
$1134.4 = 1.8127\ F_X - 1.079\ F_Y - 0.4547\ F_Z$
$1521.0 = -1.083\ F_X + 2.833\ F_Y - 0.1876\ F_Z$
$809.7 = -0.4515\ F_X - 0.1878\ F_Y + 3.2432\ F_Z$
$F_X = 1892.4$ $F_Y = 1787.9$ $F_Z = 610.2$

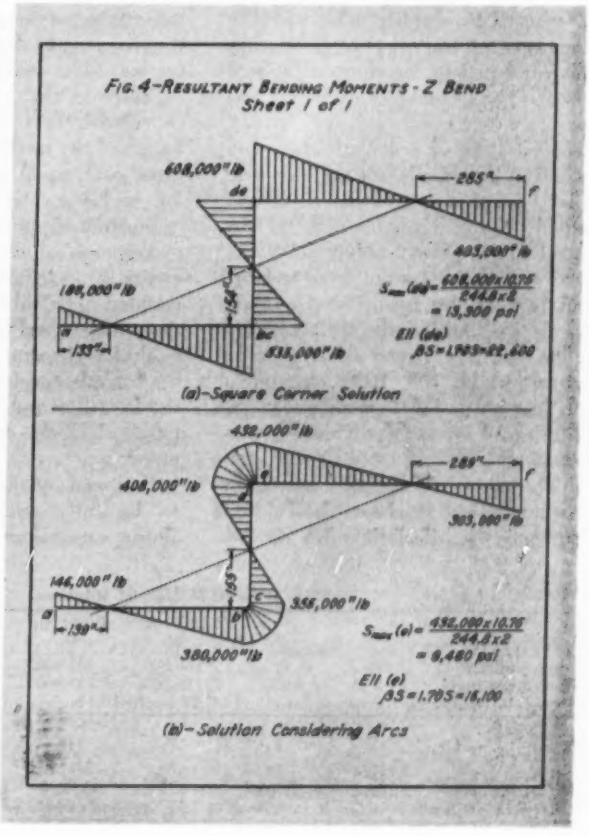


Fig. 4 – Resultant Bending Moments – Z Bend
Sheet 1 of 1
608,000" lb
285"
403,000" lb
189,000" lb
154"
133"
535,000" lb
$S_{max}(de) = \frac{608,000 \times 10.75}{244.8 \times 2} = 13,900$ psi
EII (de)
$\beta S = 1.783 = 82,600$
(a) – Square Corner Solution
432,000" lb
408,000" lb
289"
303,000" lb
146,000" lb
169"
139"
356,000" lb
380,000" lb
$S_{max}(a) = \frac{432,000 \times 10.75}{244.8 \times 2} = 9,480$ psi
EII (a)
$\beta S = 1.705 = 16,100$
(b) – Solution Considering Arcs

lations are fairly easy to keep in mind without referring to a handbook or a set of "cases" such as are shown in Fig. 1.

Solutions Shown in This Article

Complete solutions are shown in this article for both problems using square-corner approximations.

Solutions considering the arcs may be accomplished by following the same procedure but require continual reference to appropriate cases. The sample problems have been solved both ways by the present authors and the results are given in Table 1.

From Table 1 it may be observed that the maximum stress values are practically equal for both solutions of the Hovgaard problem. These stresses occur, however, at different points in the system. The maximum stress of 15,874 psi occurs at point *b* in the square-corner solution while the maximum stress of 15,856 psi occurs at the left end of the system when the arcs are considered. This difference in location of maximum stress is often encountered in comparing approximate solutions with the more exact methods.

In both problems a divisor has been used to simplify calculation. In the square-corner approximation a divisor equal to the shortest leg was used. The advantages of having one or more legs equal to 1 are obvious. The selection of a divisor when considering the arcs is not quite so simple. In these problems a divisor equal to the virtual length of the bend for in-plane bending ($\pi R/2K$) was used. This was not quite as helpful in reducing multipliers to unity as in the case of the square-corner approximation, hence some other divisor such as 100, 1000, etc., might be just as useful depending on specific problems and individual preferences.

The two problems were solved by both methods as shown in Table 1 but only the calculations for the two square-corner methods are reproduced here. The arcs may be considered by following the same procedure and applying the cases shown in Fig. 1. It may be observed in Case IV that a member is considered 1.3 times as flexible in torsion as a member acted upon by bending. This is taken into account in the moment area diagrams by making the abscissa of the bending moment diagram 1.3 times its actual length.

Definite Procedure Should Be Followed

In solving a flexibility problem by the grapho-analytical method, considering a three-dimensional problem such as the Hovgaard bend, for instance, a definite procedure should be followed. The bending moment diagram is first constructed considering only one plane at a time. Each force acts in two planes; for instance, the F_X force acts in both the *X-Y* and *X-Z* planes. The member which is perpendicular to the plane under consideration is always in torsion with respect to the plane being investigated. The lengths of the component parts are laid off consecutively on a horizontal base line. It should be noted that no effort to show lengths to scale is necessary. In this case the true lengths divided by the shortest leg (77.3 in.) were used. The F_X force in the *X-Y* plane was first considered, thus making the virtual length of the member in torsion (element *c-d*) equal to $(77.3/77.3) \times 1.3 = 1.3$.

In order to avoid complications as to the sign of the bending moment areas some convention should be adopted. In this article, following the practice used in the Piping Handbook, the element first acted upon by the force is consistently drawn above the base line and its direction of rotation, clockwise or counter clockwise, noted.

Both ends of the bend are assumed to be fully anchored; hence, the linear expansion between the ends caused by a change in temperature is compressed back into the bend. The magnitude of this linear expansion is determined as shown in the solution. The flexural rigidity of the bend which resists this compression causes forces and moments at the anchor points. In order to determine the relations existing between the forces and the expansion which they compress back into the bend, the left end is considered as fixed and the right end movable. The forces and moments are shown acting in a direction so as to oppose movement of the free end. The ends of the bend thus being restricted from rotation, the algebraic sum of rotations, and hence the summation of the moments from one end of the bend to the other, is equal to zero. This permits the ordinate of the resisting moment diagram to be determined directly. The magnitude of the restraining moment at the free end of the bend or the ordinate of the resisting moment diagram are determined by dividing the algebraic summation of the bending moments (those above the base line in this example) by the summation of the length of the components, either virtual or true, as the case may be. The ordinate thus determined is then multiplied by the length of each element, again real or virtual, to determine the area of the resisting moment diagram for each element.

The deflection at the free end of each component part is the algebraic sum of two deflections, each of which bears a definite relation to the moment area diagrams. The first portion of this deflection is due to the accumulated rotations of the elements which are to the left of the element in question. This portion of the deflection is equal to the algebraic sum of all of the areas of bending moment diagrams, preceding the element in question, multiplied by the length of the element. The relation of this deflection to the bending moment diagram is illustrated by Case I in the solution of the Hovgaard problem.

The second portion of the deflection of the free end of the component part is due to the forces and moments which act on the element itself. The rotation of each element is found by

TABLE 1 — RESULTS of solutions

Z-bend	F_X	F_Y	Left end M_a	Right end M_t	Maximum M_c	Maximum* S_c
Square-corner	3,456.2	1,412.1	188,000	403,000	608,000	22,600
Arcs considered	2,553.5	1,050.7	146,000	303,000	432,000	16,100

*Stress intensification factor, β, for elbow = 1.70 applied to both solutions.

Hovgaard problem	F_X	F_Y	F_Z	Left end M_X	Left end M_Y	Left end M_Z	Right end M_X	Right end M_Y	Right end M_Z	Max.* stress
Square-corner	1,832.4	1,787.8	610.2	56,180	8,581	127,410	105,800	84,130	54,560	15,874
Arcs considered	1,769.2	1,765.4	629.7	53,880	12,500	134,300	99,050	80,900	68,200	15,856

*Stress intensification factor, β, for elbow = 1.017 applied to both solutions.

dividing the area of the diagram for the bending moment which acts on the element by EI, and its relation to the bending moment diagram as regards the Hovgaard problem, is given by Case II and Case III. Only the first three cases are utilized in the square-corner approximation, thus attesting to its relative simplicity. When the arcs are to be considered, Cases IV through X must also be used.

Symbols Used in This Article

The symbols used here are:

Δ_X = deflection along the X axis, in.
Δ_Y = deflection along the Y axis, in.
Δ_Z = deflection along the Z axis, in.
F_X = force along the X axis, lb.
F_Y = force acting along the Y axis, lb.
F_Z = force acting along the Z axis, lb.
l = length of cantilever or section of pipe, in.
E = modulus of elasticity of pipe material at the working temperature of the piping, lb per sq in.
I = moment of inertia of pipe cross section, in.^{4}
K = rigidity multiplication factor = $(1 \times 12\ h^2)/(10 \times 12\ h^2)$.
h = $(t\ R/r^2)$ = pipe bend ratio.
M = bending moment at section indicated in.-lb.
B = longitudinal stress multiplication factor.
t = thickness of pipe wall, in.
R = mean radius of bend, in.
r = mean radius of pipe cross section, in.
ψM = rotation due to a moment at the end of a cantilever. = area of rectangular bending moment diagram, divided by EI.
ψF = rotation due to a transverse force at the end of a cantilever. = area of triangular bending moment diagram, divided by EI.
ψb, c, etc. = algebraic sum of the rotations of the elements between the point designated by the subscript and the fixed end of the section of piping. = algebraic sum of the areas of the bending moment diagrams to the left of the point designated by the subscript, divided by EI.

In these problems, the sign convention used — as previously mentioned — was to consider any force which acted to oppose movement as positive. In the three-dimensional problem, F_X forces acting left, F_Y forces acting down, and F_Z forces acting into the page, were considered positive forces. When the simultaneous equations are set up for final solution of the forces, this must be kept in mind. In addition, the divisor enters into the left side of the equation in the cubed form. ψF, ψM, ψb, ψc, etc., all being moment areas contain the divisor squared. The lengths were divided through at the outset. Hence, in the final equations, $EI\Delta$ must be divided by the divisor cubed, in order to balance the equations.

Slide Rules Can Be Used Satisfactorily

In the preparation of this article, the authors used slide rules to make the preliminary calculations of the two square-corner examples and later checked these two problems on an electric calculating machine. The results which were obtained are compared in Table 2.

The maximum variation in these values is less than 1½ percent. This comparison is reassuring in that in problems of the same general proportions as these examples, slide rules can be used satisfactorily in applying the grapho-analytical method.

Resultant Bending Moments Shown in Fig. 4

Once the reacting forces have been determined, it is a simple matter to find the resultant bending moments throughout the structure by means of the bending moment diagrams. The resultant bending moments for the Z-bend as determined by both a square-corner solution and a solution considering arcs are shown in Fig. 4.

If the lengths of the line are drawn to scale, as in Fig. 4, and the bending moments to some other appropriate scale, the points of inflection or zero bending moment will be found to lie on a straight line.

The construction of resultant bending moment diagrams to scale is always helpful in assuring that errors in direction of rotation have been eliminated.

In comparing results of the square-corners solution with that taking arcs into account in Fig. 4, it may be noted that essentially the same locations of zero bending moment result from the two solutions. This means that the best locations for flanged joints and supports are found by either solution.

TABLE 2 — COMPARISON of results

Z-bend	F_X	F_Y	F_Z
Slide rule	3430.	1392.	—
Calculator	3456.2	1412.1	—
Hovgaard bend			
Slide rule	1832.	1780.	607.
Calculator	1832.4	1787.8	610.2

If the same stress intensification factor for elbows is applied to both solutions, the maximum stress in the Z-bend as found by the square-corner approximation is 40 percent* greater than the more rigorous solution. The reacting forces are approximately 35 percent greater.

If the stress intensification factor for elbows were disregarded in the square-corner solution, as is the practice of some design groups, the bending stress found from the square-corner solution would be only 80 percent of that found by the solution taking arcs into account. In the absence of other guides, the safer procedure would seem to be to apply stress intensification factors to the square-corner solutions, although the results may, in some instances, be unduly conservative.

Bibliography

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2) *Stresses in Three Dimensional Pipe Bends*, by William Hovgaard, Trans. ASME, Vol. 57, 1935, Discussion Vol. 58, 1936. See also *Further Studies of Three Dimensional Pipe Bends*, Trans. ASME, Vol. 59, 1937, Discussion Vol. 60, No. 7, October 1938.

3) *Elastic Properties of Straight Pipe and Bends*, by Sabin Crocker and Arthur McCutchan, Chapter VII, Piping Handbook, 4th Edition, 1945, McGraw-Hill Book Co., Inc., New York.

4) *Piping Flexibility and Stresses*, by D. R. Zeno and S. D. Vinieratos, 1941, Cornell Maritime Press, New York.

*This difference is true only for this problem. A more general comparison of square-corner solutions vs. solutions considering the arcs is given for a number of different configurations in Tube Turns, Inc. "Piping Engineering" Paper No. 4.02 entitled "Z-, L-, U- and Expansion U-Bends".

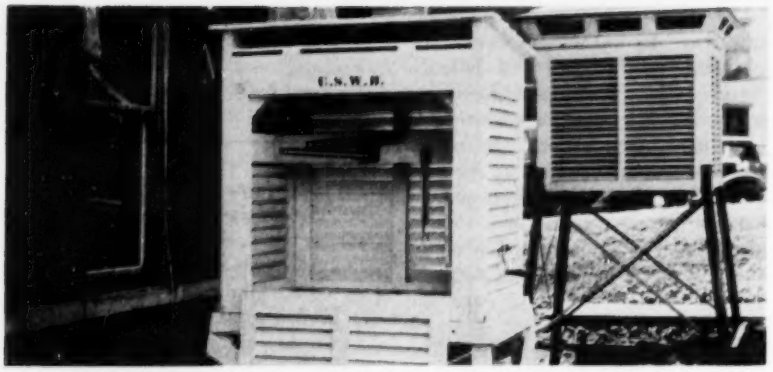


FIG. 1—THERMOMETER SHELTER used by Weather Bureau. Handle at right is to drive psychrometer fan to obtain wet bulb reading

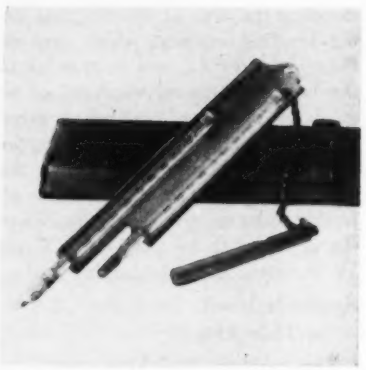


FIG. 2—POCKET SLING PSYCHROMETER uses same principle

Measuring the Weather

Air conditioning and heating engineers depend greatly on the weather. Starting off this month with a description of the basic instruments used in sensing outdoor conditions, the author will later discuss establishing proper design conditions away from weather stations, and will compare design conditions. Importance of the subject is demonstrated by the case of one large installation, where each increase of 1 deg in wet bulb temperature cost an additional $1 million for air conditioning

By A. Donald Hay

THE SCIENCE — or branch of physics — treating of the atmosphere and its phenomena — especially its variations of heat, moisture and winds — is called meteorology. Climatology treats of the average conditions of the atmosphere in a particular locality. Meteorology and climatology are used in designing air conditioning installations to establish the state of the outdoor air against which the equipment must be designed to operate with the desired requirements of capacity and flexibility.

For comfort air conditioning, reference to the atmospheric conditions at the nearest Weather Bureau will be adequate for many design purposes. Better design may be achieved by considering the micrometeorology of a region as an aid in predicting the microclimatology — or "little climates" — of a particular region. If a space is to be air conditioned with the temperature and humidity held within close tolerances every hour of every year, a careful study of meteorology must be made to insure that the equipment will function properly under extreme weather conditions.

The survival of plants and small animals depends very greatly upon the microclimate which they can create or choose. Some plants alter the position of their stems and leaves to suit their temperature and radiation requirements[1*], while small animals show remarkable ingenuity in choosing comfortable microclimates within their native locality, and in building their dwellings to take advantage of desirable weather conditions and to shield undesirable ones[2].

Man has learned to control some of the energy of Nature and use it to air-condition his environment, but the cost often may be reduced by taking advantage of the microclimates offered by Nature instead of blindly bucking her. The designer should be aware of the principles of microclimatology even when he ignores their effect in the solution of a particular problem.

Weather Characteristics Affecting Air Conditioning

The primary factors considered in air conditioning weather analysis are the dry bulb, wet bulb and dew point temperatures, the wind velocity and

Mr. Hay has had experience in the advanced engineering section of the air conditioning division of a prominent manufacturer, in the air conditioning design section of a well-known firm of consulting engineers, as a teacher of air conditioning in the school of engineering at Princeton University, and as a senior staff engineer at the Franklin Institute Laboratories.

*Superscripts refer to references to appear in the last article of this series.

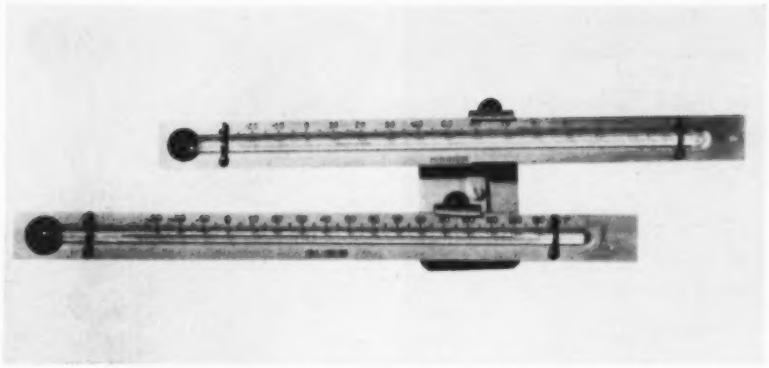


FIG. 3—MAXIMUM AND MINIMUM THERMOMETERS are also placed in each climatological station thermometer shelter

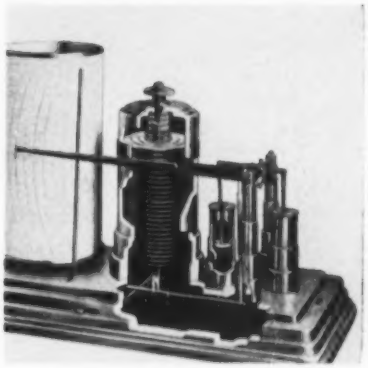


FIG. 4—MICROBAROGRAPH for recording barometric pressure.

the solar radiation. Any two of these three temperatures at a given pressure will define the state of the outdoor air and its heat and moisture content.

Each of these factors — which are characteristics of the outdoor weather — directly affects the state of the indoor air and therefore the performance of the air conditioning equipment.

The difference in the dry bulb temperatures between indoor and outdoor air is required in calculating the heat transfer through the walls of the structure.

The difference in dew point temperatures is required in calculating the moisture penetration through walls.

Both temperatures are needed in calculating the heating or cooling load required to counteract untempered air which enters the conditioned space through doors and windows, or by a ventilating fan.

The magnitude of the wind velocity materially affects the size of the air film on the outside of the structure, and therefore its heat transfer. It also alters the quantity of untempered air which enters the conditioned space around doors and windows, thus contributing to the air conditioning load.

The solar radiation which falls on the walls and the roof of a structure alters the previously-mentioned heat flow through the construction material caused by the conduction and convection of the air on the two sides of any wall or roof section.

If the temperature and humidity within an air conditioned space are to be precisely maintained at a constant value, any change of dry bulb, wet bulb or dew point temperature, wind velocity or solar radiation will require a compensating change on the part of the air conditioning installation.

Instruments Used To Determine the Weather

The designer of an air conditioning installation must be able to predict the extreme future weather conditions to which his equipment will be exposed. The period of interest may be as long as 30 to 40 years, the expected life of the equipment. Meteorologists must know the conditions of the upper atmosphere in order to forecast the daily weather, but only the weather conditions a few feet above the ground are of direct interest to the air conditioning designer, and he is not particularly interested in the exact sequence of weather from day to day except for the calculations of thermal storage within the walls of heavy buildings.

Two forms of instruments are used in studying the weather: Those which show an instantaneous reading and leave no record, and those which automatically record data for future study. The latter form often provides a reading at the same time that it is recording. The common instruments will be discussed.

The state of the outdoor air is established by measuring the dry and wet bulb temperatures of the air and the total atmospheric pressure. For observational purposes, dry and wet bulb mercurial thermometers are mounted in a louvered thermometer shelter, Fig. 1, which is exposed to the sun and wind. A stream of air is caused to pass over the wetted wick of the wet bulb thermometer either by hand operating a propeller fan within the shelter, or by whirling the thermometer inside the shelter by rotating a hand crank mounted on the outside of the shelter. The action is similar to that of the hand operated psychrometer of Fig. 2.

The shelter of each climatological station also contains a pair of maximum-minimum thermometers, Fig. 3. The thermometer which is to record the maximum daily temperature is a normal mercurial thermometer mounted with the bulb slightly higher than the stem with the exception that it carries a constriction in the capillary between the bulb and the stem. When the temperature rises, the mercury is pushed away from the bulb, but when the temperature falls the mercury column breaks at the constriction and remains at its highest reading until the thermometer is reset. To reset this thermometer the bulb is lowered and swung as a pendulum; centrifugal force reunites the mercury column.

The thermometer which is to record the minimum daily temperature is alcohol filled, mounted horizontally, and contains a specially shaped index approximately ½ in. long which is kept submerged in the alcohol column by surface tension of the meniscus. The index is drawn toward the bulb as the temperature falls, but remains stationary at the lowest point when the alcohol column begins to rise. The thermometer is reset by tipping the bulb upward until gravity causes the index to slide down the tube to the surface meniscus of the alcohol.

For purposes of recording, different principles are used. The temperature sensitive elements are common-

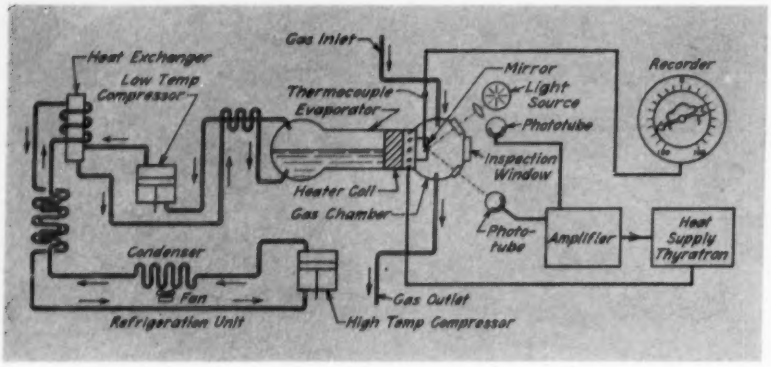


FIG. 5—DEW POINT TEMPERATURE may be found directly with an instrument, or calculated from known characteristics of moist air

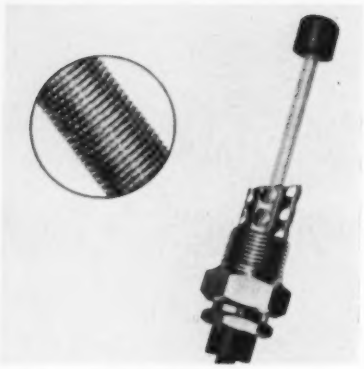


FIG. 6—DEW POINT is also determined by this instrument

ly distance thermometers, electric resistance thermometers, or bimetallic strip thermometers. The distance thermometer bulb is large and filled with a volatile liquid. A change in the temperature of the bulb changes its vapor pressure and this pressure acts upon a bourdon tube or bellows to create a mechanical motion. A change of temperature of an electrical conductor will change its electrical resistance, and thus the current flowing through it. This may very accurately be converted into mechanical motion in a number of ways. A bimetallic strip, composed of two pieces of metal having different coefficients of expansion, will bend as its temperature changes. The mechanical motions produced can operate a recording pen.

The atmospheric pressure is observed on a mercurial barometer when a primary reading is desired. A record of the history of the atmospheric pressure is traced by a barograph, Fig. 4, wherein a change of atmospheric pressure on the outside of a metallic bellows changes the length of the bellows and actuates a pen through an amplifying linkage. Graph paper, wrapped around a drum, is drawn past the pen at uniform speed to produce the record.

Measuring the Dew Point Temperature

The dew point temperature may be found directly with an instrument, or calculated from other known characteristics of the moist air. Using the common definition that "the dew point temperature is the temperature at which the water vapor in an air-vapor mixture becomes saturated and moisture begins to condense when cooled at constant pressure," a continuous sample of air may be caused to pass over a mirror which can be cooled by external refrigeration and heated electrically, whose temperature accurately can be measured with a thermocouple as illustrated in Fig. 5. At a sufficiently low surface temperature of the mirror, moisture will start to condense on the bright surface and scatter the light focused upon it. This measured temperature is the dew point temperature of the sample. Because this condensation abruptly diminishes the reflected light from the mirror surface, a photo-electric cell may be placed so as to detect this point and actuate control mechanisms to keep the mirror surface at this dew point temperature.

An entirely different principle may be employed if the alternate definition of dew point temperature is used; that is, "the dew point temperature is the saturation temperature corresponding to the partial pressure of the vapor constituent." A temperature sensitive element, Fig. 6, may be placed inside a thin walled metal tube covered with a woven glass tape impregnated with dry lithium chloride, a hygroscopic salt. Over this tape is wound a pair of silver wires upon which is impressed a constant voltage. A perforated metal guard surrounds and protects the sensitive parts. Initially the lithium chloride is dry and offers very high resistance to the flow of electric current between the silver wires, and the heating effect is negligible. The temperature sensitive element in this case indicates the dry bulb temperature of the air. The hygroscopic salt immediately absorbs moisture from the air, as its partial vapor pressure is less than that of the atmospheric air. The lithium chloride (salt) solution which results does permit electric current to flow between the silver wires, thus producing a heating element. The heat affects the temperature sensitive element, raising it above the dry bulb temperature, and simultaneously tends to drive moisture from the heated lithium chloride solution, which is contained within the woven glass tape, until equilibrium is established between the vapor pressure of the lithium chloride solution and the vapor pressure of the moisture in the air. When this is established, the current between the silver wires, the heating effect, and the thermometer reading will remain constant. The thermometer reading is dependent only upon the partial pressure of the vapor in the air. This thermometer may therefore be calibrated against the dew point temperature as an instrument for measuring the dew point temperature of the moist air.

How the Wind Velocity Is Measured

The velocity of the wind is normally measured by either of two instruments. Most Weather Bureau stations use a cup type of anemometer for the purpose, the most favored of which uses a three-cup rotor as shown in Fig. 7. This rotor moves as a result of the difference in forces against the convex and concave faces of the cups, and because of this the linear speed of the cups must necessarily be much less than that of the wind. This instrument measures wind velocities from 2 to 100 mph. Although instantaneous readings can be made, it is normal to automatically count the revolutions of the rotor over a

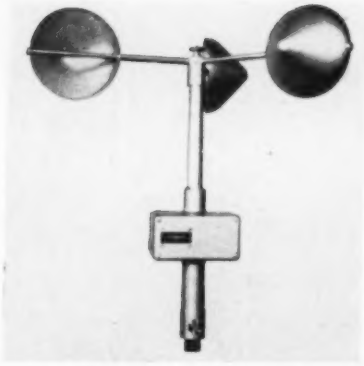


FIG. 7—WIND VELOCITY is measured at most Weather Bureau stations by a cup type anemometer, such as that shown here

FIG. 8—THIS WIND MEASURING INSTRUMENT transmits both velocity and direction to instruments which show or record the readings

FIG. 9—INTENSITY OF SOLAR RADIATION is measured by a pyrheliometer. Difference of two readings gives direct insolation

given period of time and obtain the average velocity during that interval. Although the rotor responds quickly to an increase in wind velocity, it tends to overtravel as the wind decreases. This effect will tend to produce an inflated average velocity.

Associated with this instrument is the wind direction transmitter or weather vane. This weather vane can transmit, for distant observation, either the exact wind direction or the closest of eight points of the compass, depending upon construction.

The other wind measuring instrument, Fig. 8, combines both of the above. A large tail is pivoted to act as the weather vane and to keep the propeller, which measures the wind velocity, pointed into the wind. The velocity and direction of the wind are transmitted electrically to instruments which either show or record the instantaneous readings.

Determining Intensity of Solar Radiation

The intensity of the solar radiation is measured by a pyrheliometer. The Weather Bureau wishes to measure that portion of the radiation which has wave lengths between 0.295 μ and 2.5μ[3] (μ = 1 micron = 10^{-6} meters = 10^{4} Angström units). Solar radiation below 0.36 μ is called ultraviolet, while that above 0.76 μ is called infrared. As received at the surface of the earth, less than 4 percent of the solar energy is in the ultraviolet range, while 43 percent is in the visible range (between 0.36 μ and 0.76 μ), and 53 percent in the infrared range.

The U. S. Weather Bureau has adopted the pyrheliometer shown in Fig. 9 for most of its radiation measurements. It is used to measure the total radiation from the sky which falls on a horizontal plane, and, by shielding the sensitive element from the direct rays of the sun, it is also used to measure the diffuse sky radiation. The difference between these two simultaneous readings is the direct insolation from the sun.

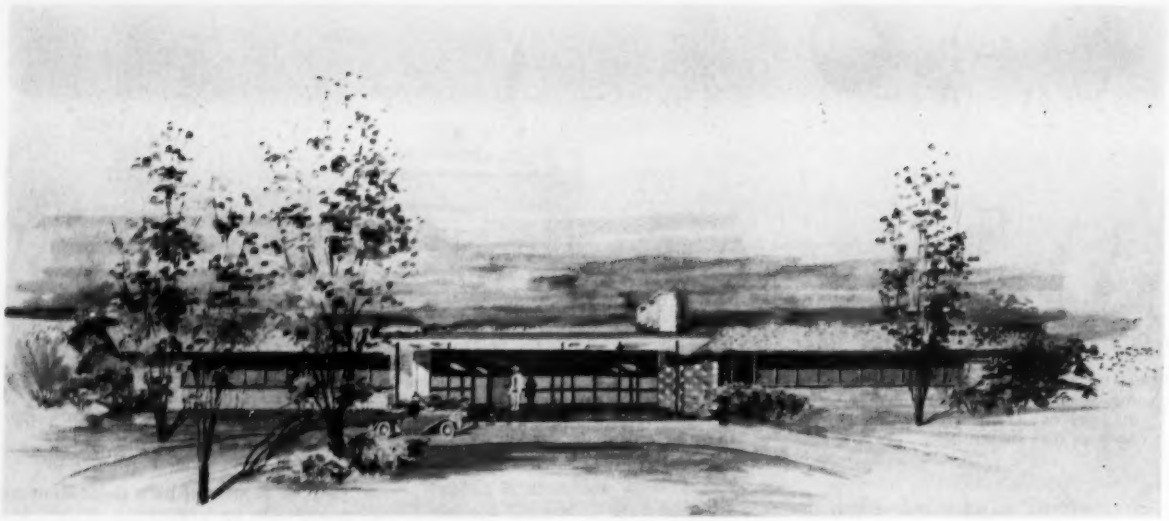
FIG. 10—SUNSHINE DURATION TRANSMITTER is used for measuring the length of time the sun is shining on the instrument

This pyrheliometer consists of a "hot ring" painted with lamp black surrounded by a "cold ring" smoked with (white) magnesium oxide. The blackened surface absorbs the solar radiation and warms, while the magnesium oxide has a high coefficient of reflection for solar radiation and remains cool. The resulting marked temperature difference is measured by either a 10-junction or 50-junction thermocouple. The voltage produced by the thermocouple is very nearly proportional to the intensity of the solar radiation[4]. The sensitive element is protected by a 3 in. diameter lamp bulb of soda lime glass which transmits about 10 percent of the incident radiation at 0.29 μ and 58 percent at 0.31 μ, and most of the radiation of longer wave length falling upon it. The voltage produced by the thermocouple may be balanced by a hand adjusted potentiometer and read, or it may be recorded by an automatic instrument. Each instrument must be calibrated by the manufacturer or the Weather Bureau to give the correct solar intensity, which is measured in gram calories per cu cm per second.

A sunshine duration transmitter, Fig. 10, is used merely for measuring the length of time that the sun is shining on the instrument. An evacuated tube contains two bulbs connected by a small tube. The lower bulb is painted black and filled with mercury; the upper bulb is clear and contains alcohol vapor. The instrument is so adjusted that when direct insolation from the sun strikes the two bulbs, the mercury (in the blackened tube) receives heat more readily than the alcohol, and the resulting expansion of the mercury moves it up the small connecting tube past two electrodes. This closes a circuit which records the fact that the sun is unobstructed.

[Figs. 1 and 3 courtesy of U. S. Weather Bureau; Figs. 2, 4, 7, 8 and 10 courtesy of Friez Instrument Div., Bendix Aviation Corp.; Fig. 5 courtesy of General Electric Co.; Fig. 6 courtesy of the Foxboro Co.; Fig. 9 courtesy of Eppley Laboratory.

Future articles by Mr. Hay will be devoted to heat and moisture exchange, global meteorology, climatology of the United States, micrometeorology, and analysis of weather conditions to achieve economy in air conditioning.]



HEATING THE BUILDING is by a hot water radiant floor system, plus finned tube convectors

Ventilating and Heating Publisher's Home Office

Paul Moffet, the architect, describes briefly the design of the suburban home office building for a magazine publisher. Careful studies of the sun were made to utilize its heat in winter, keep it out in summer

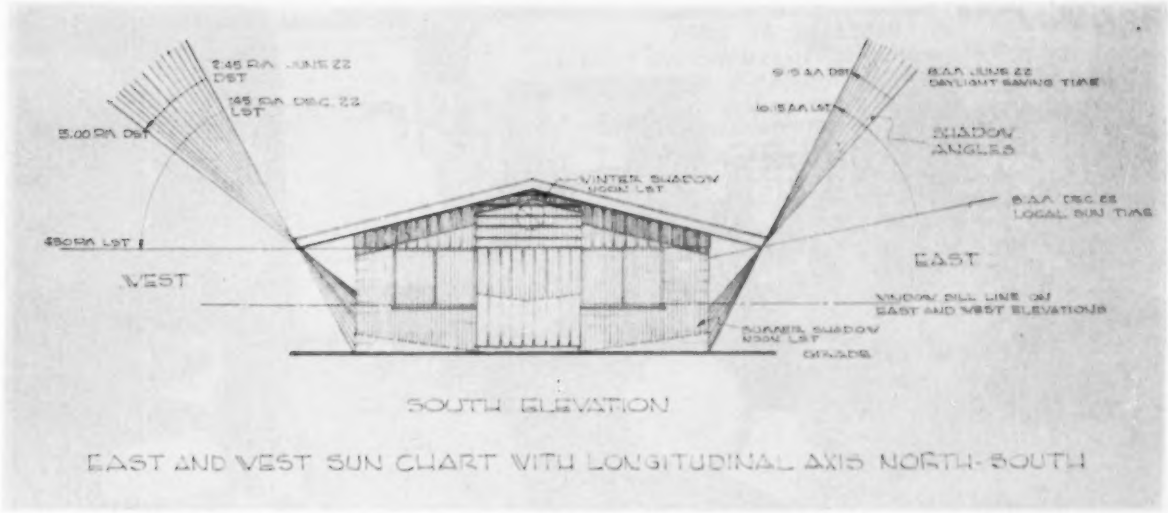
Roy T. Bramson, publisher of Production magazine, commissioned us to design a building in Birmingham, Mich., around his publishing operation. We employed what we call "contemporary thinking" in solving the circulation, space allocation and other functional requirements.

Because of the probable changes and expansion of the business operation, we elected to clear span the working space with wood trusses so that partitions may be readily moved for ever-changing requirements. The building is designed on a 3 ft module with the windows so arranged that 6, 9, 12 and 15 ft areas may be enclosed off of a 4 ft open center corridor. The partition walls are of finish 2 x 4 construction with either plywood or glass panels and glass at all ceiling panels to give the maximum spaciousness and yet to preserve privacy where necessary. The ceilings are of acoustical tile and the exterior walls are 8 in. cinder block, insulated and paneled in ¼ in. fir plywood. One by four vertical fir paneling is used in the entrance lobby and the conference library, with a flagstone floor that opens on to the entrance terrace and surrounds a water lily pool just outside the library. The end wall of the library houses a wood box and fireplace of cinder block and it continues through the glass entrance wall to form a block pattern which adds definition to the material form and an accent of interest to the entrance of the building.

In spaces such as the manager's office, circulation, art and production departments, and the lobby, where no future changes are contemplated, all desk furniture is built-in and integrated into the architecture.

As we approached the problem of orientation because of future land use, we deemed it necessary to face the building due west and have the longitudinal axis run directly north and south. Then, with the continuous modular windows facing east and west with their sill just 8 in. above desk height, we had a sun problem.

We found by using the top chord of our trusses to project 4 ft, 2 in. as an overhang, we could partially control the sun during the 8 a.m. to 5 p.m. working hours, which is of course the major period of the day when this building is in use. By taking advantage of daylight saving time in the summer months, at 8 a.m. — when work starts — the sun is already casting shadows below the



SUN CHART was prepared to study effect of solar radiation in summer and winter. "LST" means "local sun time", as compared to daylight saving time

windows on the east and by 10:15 a.m. there is no sun at all on the east side. As the sun passes the south side, our overhang is sloped and angled to a point which completely shades the south windows all day and most of the elevation. As the sun progresses to the west, not until 2:45 p.m. daylight saving time does it touch the west elevation and by quitting time at 5 p.m. the west's sun rays are barely coming in through the window.

For complete control of the west sun rays, in addition to light-directing window blinds the proper planting must be judiciously placed to help shade this elevation. As for the west entrance lobby and library, the 12 ft marquee shields the summer sun from them with the exception of its scattered squares which are to let rain into the pool and planting areas and these small and splashing rays of light add a fanciful bit of interest to this entrance area.

In the winter months, when we want and need the warmth and comfort of the sun, working hours are on standard time or local sun time. We find at 8:00 a.m., December 22, the sun is streaming into the east windows and reflecting through the glass panels to the west side. The sun helps to heat the interior until 10:15. As it passes around low on the horizon to the south, the south elevation is almost completely blanketed with sun. Then from 1:45 p.m. until sunset at 4:30 p.m., the sun passes through the now bare summer planting protection to warm the building from the west.

Our sun studies were developed on the premise that Detroit would go on daylight saving time last year. It had been tried and rejected, in previous years, but we thought we had inside information that it would be tried again and accepted. However, we were crossed up, and as a result our west summer sun control has to depend slightly more on planting than overhang as it is designed for daylight saving time.

As this office is well on the outskirts of town and is surrounded by green fields in the summer, the temperature varies from 10 to 15 deg below city temperature. We therefore felt that with forced ventilation we would move enough air for proper summer cooling. Two 24 in. fans, one at each extremity of the building, move 4750 cfm and change the building air completely every four minutes. The triangular area formed by the trusses acts as an air plenum and at four points in the building automatic shutters operated by the vacuum created by the two fans move building air into the plenum and out the ends through a louver box — drawing outside air through the ventilating windows.

Window air conditioning units are used in three of the offices.

For heating in the winter time, we have a hot water radiant system with welded pipe in a grid system. Floor control boxes are located in various closets and under built-in seats. The pipe was laid over 4 in. of insulating concrete and 4 in. of regular concrete, with 6 x 6 x 10 wire mesh reinforcing, was poured around and over the pipe. Finned tube convectors are used along the exterior walls.

Aluminum reflective insulation is used behind the plywood in the exterior walls and in the ceiling. The sliding aluminum windows are double glazed and other fixed glass is storm sashed with thin aluminum housed double strength glass.

HEATING WHOLESALERS TO MEET IN NEW YORK

THE SECOND ANNUAL convention of the American Institute of Wholesale Plumbing & Heating Supply Associations, Inc., will be held in New York City at the Waldorf-Astoria on September 20, 21, 22 and 23. Convention chairman is M. W. Dennison, Braman, Dow & Co., Boston.

Last year's convention was held in Atlantic City, under the direction of W. A. Brecht, of the Hajoca Corp.

Membership of the group comprises the Middle Atlantic Wholesalers Association, the New York State Plumbing and Heating Wholesalers, Inc., the Plumbing and Heating Wholesalers of New England, Inc., the Southern Wholesalers Association, and the Wholesale Distributors Association.

George T. Underwood, 402 Albee Bldg., Washington, D. C. is the executive secretary.

ASHVE Exhibit Gets Crowds

Working example of cooperative research study at the University of Illinois plays to good audiences at recent exposition

A "WORKING EXAMPLE" of the American Society of Heating and Ventilating Engineers' cooperative research program drew crowds six times a day during the International Heating, Ventilating and Air Conditioning Exposition. In one half of the ASHVE's educational exhibit on the second floor of the big show, the Departments of Medicine and Mechanical Engineering of the University of Illinois presented a demonstration of the physiological adjustment of a clothed person to sudden changes of temperature and humidity. The demonstration covered one phase of the physiological research program which the Society, with the financial support of the United States Public Health Service and the University of Illinois, has been sponsoring at the University for the past 17 years.

The exhibit included two small air conditioned rooms, each with two transparent walls and a door. The conditions in one (75 F and 50 percent relative humidity) simulated those of an air conditioned space, and those in the other (100 F and 60 percent relative humidity) simulated those of a hot and humid street during the summer.

An attractive model — dressed in typical summer apparel and fitted with special temperature measuring thermocouples — after sitting in the comfort air conditioned environment for 10 minutes, passed rapidly into the hot-humid street environment. After remaining in the hot-humid environment for 10 minutes, she returned to the comfort air conditioned environment.

Special Instruments Show Temperature Changes

Special instruments showed on charts the rapidity and magnitude of the changes in the body and skin temperatures of the girl as she passed from one environment to the other.

and medical doctors from the University's Department of Medicine emphasized the important temperatures and explained the significance of the changes. This complete demonstration was repeated six times each day. A mannequin showed the thermocouples for measuring the skin and body temperatures.

The experiment, as depicted in the exhibit, of exposing individuals to sudden changes in atmospheric environments with widely different thermal properties imposes on the subject a standard type of stress. The ability to withstand this stress is dependent on circulatory adjustments which prevent heat retention. Many individuals with organic heart disease have been able to withstand this stress surprisingly well. Others have shown rising rectal temperatures, marked increases in pulse rate, and other signs of circulatory inadequacy.

The experiment serves to show the pathways of circulatory failure on exposure to hot moist conditions and to furnish a method of prediction of the types of organic heart disease which can withstand such exposure.

The comprehensive exhibit was built and operated by the Department of Mechanical Engineering, and its attractiveness and educational effectiveness was largely due to advice and services given by the medical illustration studios of the University's College of Medicine. Through gifts of equipment, furnishings and materials and services, 20 different companies cooperated to make the exhibit possible. Many others offered to help.

The photo on the front cover shows Dr. Raymond Hussey, Scientific Director, Council on Industrial Health, American Medical Association; Reg F. Taylor, President of the American Society of Heating and Ventilating Engineers; and Dr. Robert W. Keeton, Professor of Medicine, Emeritus, Department of Medicine, University of Illinois, and a member of the ASHVE Committee on Research, observing the display during the exposition.

The other half of the display gave further details of the ASHVE's current research activities.

Working mock-ups showed examples of the ASHVE Research Laboratory's activities, such as the effect of surface finish on radiant ceiling panels, variations in the thermal radiation transmission of different types of glass, the effect of window shading appurtenances on the heat gain through windows, and the thin plate multiple thermocouple heat flow meter instrumented to act as a radiant receiver from warm surfaces, such as the hand.

Photographs and charts showed the society's extensive laboratory building in Cleveland; the environment laboratory, which is one of its major physical facilities; and the names and geographic locations of the various research projects which are being conducted in cooperating institutions.

In another ASHVE booth on the first floor, near the main entrance, the Society provided information on its many activities, including membership and its several publications.

NEW TECHNIQUES = "NEW" BUILDING

MODERN MATERIALS and techniques — including air conditioning, fluorescent lighting, and the use of a stainless steel "skin" — have enabled the Heppenstall Co., Pittsburgh steel forgings manufacturer, to transform two old buildings and new additions into what appears to be a single, brand-new, windowless building.

Air conditioning — installed in the main Heppenstall office building in 1911 and in the annex in 1945 — has been extended to every portion of the modernized structure. Cooling water is obtained from a well on the property. Two 60 hp compressors are used.

During the winter the air circulated through the system is heated to 72 deg. Offices along outside walls get additional heat, by a hot water system, to compensate for heat losses of the walls. All radiators through which this hot water is circulated are under thermostatic control. Steam from the Heppenstall plant across the street provides the necessary heat for the system. A gas fired boiler in the office building is available for standby use.

A few of the offices are provided with electric panel heaters for off-season use; for instance, to eliminate chill on a spring or fall day when it is not desirable to heat the entire building or to take care of personal temperature preferences.

THE NEW LOOK — Stainless steel sheathing, with a base trim of terra cotta tile, gives a "brand new" look to modernized office building of the Heppenstall Co. Windowless structure is of course air conditioned throughout.

Three colored lights opposite each elevator landing, and controlled from the reception room, are used to indicate weather conditions outside. A white light indicates clear weather, green means cloudy, and red denotes rain or snow.

An unusual feature of the building is that no intakes for the air conditioning system are visible on the exterior walls. Outdoor air is drawn in through the opening between the old masonry walls and the new stainless steel sheathing. Exhaust air is discharged to the roof.

ALUMINUM PRODUCTION SETS 12-MONTH RECORD

U. S. PRODUCTION of primary aluminum during 1952 hit an all-time peak, according to Donald M. White, secretary of the Aluminum Association. "The yearly production reached a total of 1,871,642,692 lb, 34 million lb above the previous peak established in 1943," he said. The new record was 12 percent greater than the 1951 figure.

FIG. 1—TYPICAL SPECIMENS of bare steel pipe (above) and galvanized steel pipe (below) after 13 years exposure to corrosion in various soils. Specimens of galvanized steel pipe, bare steel pipe, and zinc were included in the National Bureau of Standards investigation. In many soils, galvanized specimens corroded very little

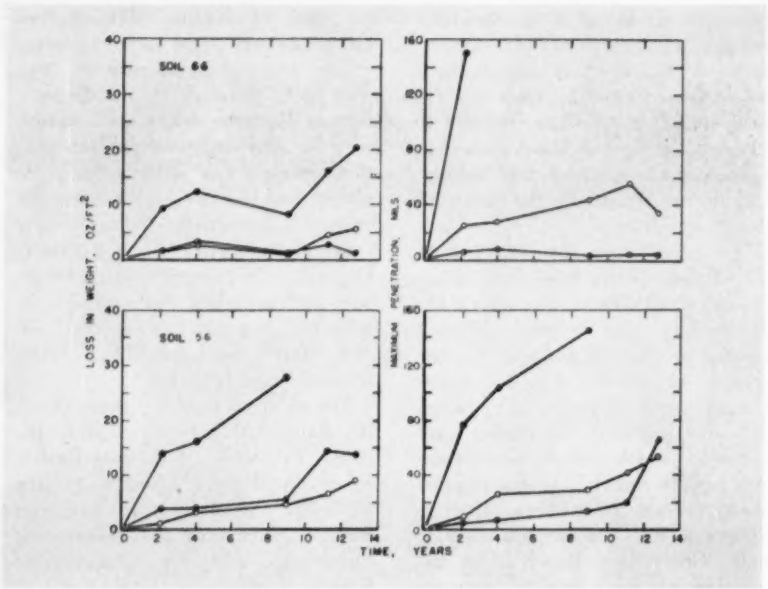


FIG. 2—WEIGHT LOSS (left) and maximum penetration (right) curves for specimens exposed to corrosion in two different soils for periods up to 13 years. Solid circles, bare steel pipe; open circles, zinc plate; half-solid circles, galvanized steel pipe. Enough specimens were buried to permit removal and inspection of two specimens of each material from each soil at the end of each of five different periods. In some of the soils, including soil 56 (Lake Charles clay), galvanized specimens continued to corrode throughout the 13 year period. In many other soils, however, including soil 66 (Mohave fine gravelly loam), corrosion of galvanized specimens was negligible in comparison with the bare steel specimens

NBS Studies Underground Corrosion of Galvanized Steel Pipe

National Bureau of Standards investigation over 13 year period indicates high resistance to corrosion in many soils

RESULTS OF A study on underground corrosion of hot dipped galvanized steel pipe recently completed by the National Bureau of Standards confirm previous NBS work in showing that galvanized steel, having 3 oz of zinc per sq ft of exposed surface, is highly resistant to corrosion in many soils which are very corrosive to bare steel. Conducted by Irving A. Denison and Melvin Romanoff of the bureau's corrosion laboratory, the present study was an outgrowth of earlier NBS exposure tests of zinc coatings for underground use.

For the bureau's study, short lengths of both galvanized and uncoated steel pipe, and also plates of zinc, were buried at 15 test sites for periods up to 13 years. Located in widely separated parts of the United States, the test sites represented a wide range of soil properties. After each of five periods of exposure, a set of specimens of each material was removed and returned to the NBS laboratories. After removal of the corrosion products, determinations were made of loss in weight, depth of the deepest pits, and the percentage of area of the galvanized specimens on which coating remained.

Actual thickness of the zinc on the

coated specimens varied over a wide range. This was shown by a large number of thickness measurements made by a magnetic method, using unexposed samples of pipe from the same lot as the buried specimens. Additional determinations by an electrolytic stripping method showed that a large part of the zinc that was applied to the steel pipe was converted into alloys of zinc and iron.

The zinc coatings provided good protection in most of the soils. In one soil in which bare steel pipe was perforated by corrosion after exposure for only a few years, the coating on the galvanized specimens remained perfectly continuous throughout the entire 13 year period. In only two of the 15 soils — both organic — was the zinc coating of negligible protective value.

An interesting finding of the NBS study was the high corrosion resistance that the galvanized specimens continued to show in most of the soils after the outer zinc coating, and even after the zinc-iron alloy layer, had entirely corroded away. This continuing protection is tentatively attributed to an inorganic coating, probably silicious, believed to have been deposited by galvanic action between the outer zinc coating and the underlying steel or alloy layer. This tentative explanation is based in part on unpublished studies which indicate that the zinc-iron alloy layer does not protect steel sacrificially (cathodically), and that the alloy is no more resistant than steel to soil corrosion.

Analysis of the data obtained in the course of the two NBS field studies shows that the minimum weight of zinc coating required to protect steel for a minimum of 10 years depends on the nature of the soil environment. In the NBS studies, a 2 oz coating gave sufficient protection in inorganic oxidizing soils, but for inorganic moderately reducing soils, a 3 oz coating was required. Highly reducing soils, both organic and inorganic, require coatings heavier than 3 oz per sq ft, according to the NBS.

In order to obtain maximum life from galvanized pipe in practice, it is necessary either to construct the entire piping system of galvanized pipe or else to electrically insulate the galvanized sections from pipe of other metals. Otherwise, the zinc coating will be removed by galvanic action.

Further details of this NBS investigation are given in "Corrosion of Galvanized Steel in Soils," by Irving A. Denison and Melvin Romanoff, J. Research NBS, 49, 299 (Nov. 1952) (NBS Research Paper 2366; 10 cents from Superintendent of Documents, Government Printing Office, Washington 25, D.C.) For information on earlier related NBS work, see "Corrosion of Metals Underground," NBS Tech. News Bull., 34, 48 (April 1950).

FEVER FROM INFECTION NOT CORRECTED BY ENVIRONMENT

[Heating, Piping & Air Conditioning asked Dr. Keeton to comment on this subject, because in a condensation of a speech by another authority published elsewhere than in HPAC an apparent but inadvertent reversal of the speaker's statement was made.—The Editors.]

THE FLUCTUATIONS IN the body temperatures of a patient are attributed to the heat regulatory center. This center is located in the hypothalamus and consists of two divisions — an upper one which is concerned primarily with the control of mechanisms designed to dissipate heat, and a lower one which increases the heat production. These are so integrated that the net results of their action leads to a thermostatic control of the body temperature, which normally fluctuates around 98.6 F. In the presence of an infection it is assumed that the bacterial products either influence the integration of the divisions of the center or interfere with the mechanisms which they use to control the body temperature.

The action of bacterial products is only secondarily influenced by the temperature of the environment. If in the summertime a patient with an infection is allowed to remain in a relatively still hot moist atmosphere the elevations of the body temperatures will be higher and may reach the levels seen in heat stroke. If the patient is exposed to low temperatures there will doubtless be an increase in the vasoconstriction and later an increased elevation of body temperature due to extra heat production. This can be confirmed by applying cold cloths and ice packs to a patient with hyperpyrexia due to an infection. The temperature drops for a short time, only to reach higher levels later. Under comfortable environmental temperatures the bacterial effect will run its normal course uninhibited by the environment.

The behavior of a patient with a simple heat retention unassociated with an infection is quite different. He will lose retained heat mathematically in a comfortable or cold environment. The heat centers in this condition are functioning normally, but for some reason, either because of the production of extra heat or a blockade to its elimination, the temperature remains elevated. Even a normal person can retain heat and have an elevated temperature if the environment prevents its loss.

I would like to make two points:

a) The presence of a fever in a patient with an acute infection is no longer considered a valuable therapeutic factor in facilitating his recovery from the causative infection.

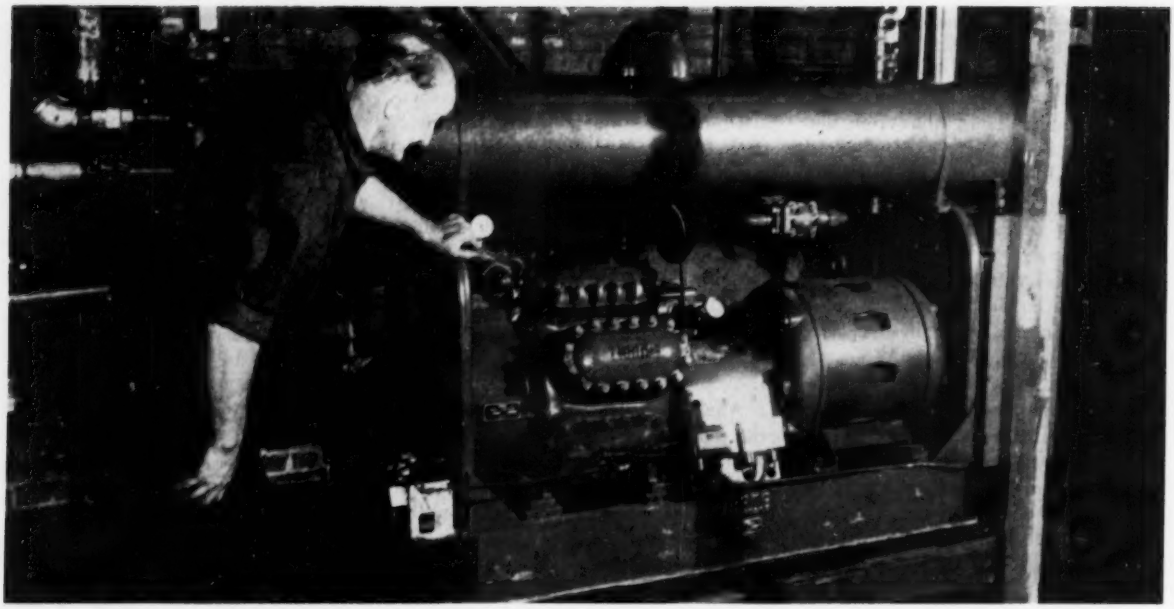
b) The fever in a patient with an infection is not correctable by altering the physical properties of the environment.

It is not the purpose of the above discussion to discount the importance of furnishing the sick comfortable environments within which they may convalesce.—ROBERT W. KEETON, M. D., Professor of Medicine, Emeritus, Department of Medicine, University of Illinois.

TO HOLD ODOR CONFERENCE IN NEW YORK NEXT MONTH

A TWO-DAY conference on "basic odor research correlation" is scheduled for April 23 and 24 at the Barbizon-Plaza hotel, New York City, under the sponsorship of the American Society of Heating and Ventilating Engineers and the New York Academy of Sciences.

Speakers will discuss the odor problem in industry and sciences, basic types of industrial odor problems, odor research problems from the viewpoint of the scientist, the olfactory process, and measurement techniques and experimental studies of odor.



THE PACKAGE WATER CHILLER that supplies cooling water for Great Lakes Plating's electroplating baths. The unit incorporates the complete refrigeration cycle, requires only simple piping and wiring connections

Water Chiller Ups Production of Electroplating Tanks

By M. L. Hoglund

Manager, Refrigeration Dept.
The Trane Co.

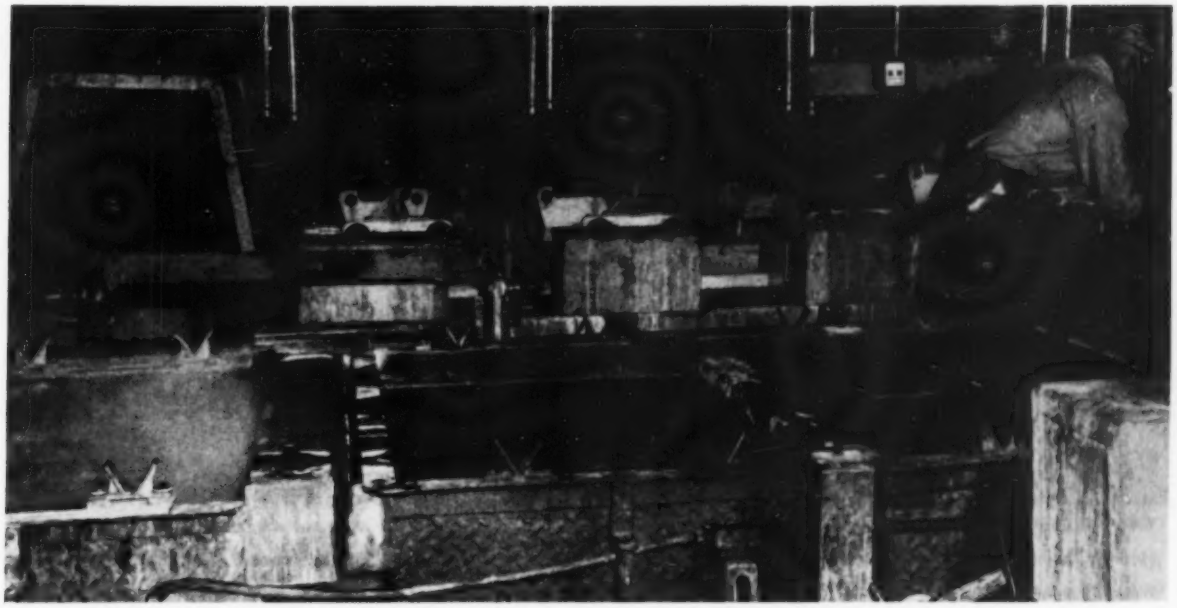
50 ton unit furnishing 150 gpm of 45 F water to plate type coils immersed in three plating tanks allows high current density

A RECIPROCATING compressor water chilling system, recently placed in operation at the Great Lakes Plating Div. of Great Lakes Industries, Chicago, has helped to raise production and solve a long-standing cooling problem at the same time. The problem was to cool and maintain certain temperature levels in Great Lakes' electroplating bath tanks — particularly in the summer, when Lake Michigan water temperatures are too high for the job.

Equally important was the fact that company engineers wanted to use high current density in the plating process; this raises production, but also increases the amount of heat generated in the plating baths.

Mechanical zinc plating bath temperatures must be held between 75 and 90 F for most efficient production. Customarily, platers circulated ordinary tap water through cooling coils in the plating tanks to maintain these temperatures. During the cooler months, when lake water temperatures are low enough, this was adequate to handle the heat generated by ordinary amperage. However, during the summer, when the lake water in city mains approached temperatures in the 70's, work loads often had to be reduced to insure proper bath temperature.

When bath temperatures rise above 90 F, the sodium cyanide in the bath breaks down into carbonates which reduce conductivity. Thus, the efficiency of the plating operation drops, and the platers get several un-wanted results — granular, off-color deposits on the products; lack of brightness; and poor adhesion of the plating.



SOME OF THE ELECTROPLATING tanks. The new bath cooling system, using refrigeration unit to supply 45 deg water, permits the use of high current density and eliminates summer shutdowns

Previously, when the city water temperatures rose above the required level, platers had these alternatives: They could shut operations down until the warm season was over. They could drop blocks of ice into the plating bath for cooling (which tended to dilute the plating solution and lower its effectiveness.) They could circulate refrigerant through pipe coils in the tank (which was expensive, due to frequent leaks.) They could circulate chilled water through cooling coils in the tank with little or no automatic control.

Water Chilling Permits High Current Density

The bath cooling system now in use at Great Lakes Plating employs a 50 ton water chiller package. The heart of the system is a reciprocating compressor-condenser unit, cooling 150 gpm of water to 45 F for six plate type cooling coils. These coils are immersed in three plating tanks — one cadmium plating tank and two zinc plating tanks. Each is a five barrel tank. Normally, bath temperatures are held at about 80 F.

In addition to providing complete, individually controlled cooling for each tank, the new water chilling system permits the use of high current density in Great Lakes' plating operations. Production increases due to the high current density since the installation of the new cooling system at Great Lakes have been estimated as high as $75 an hour. Normal currents used in similar plating operations are about 500 amp per barrel at 10 volts. Since installing the refrigeration system, Great Lakes has been able to use 1000 amp at 15 volts per barrel in its plating tanks. This has greatly increased production with small additional labor costs. It has been estimated that the water chilling equipment has paid for itself within four to six months of summer operation.

Temperatures in each of the three plating tanks are controlled individually. A remote bulb controller, encased in plastic to prevent corrosion, is placed in each tank. These bulbs regulate three-way bypass valves so that the water from the chiller is bypassed around the tanks when less cooling is required. Bath temperatures in the tanks can be maintained at any selected point above 45 F.

Summer To Winter Change-Over Simple

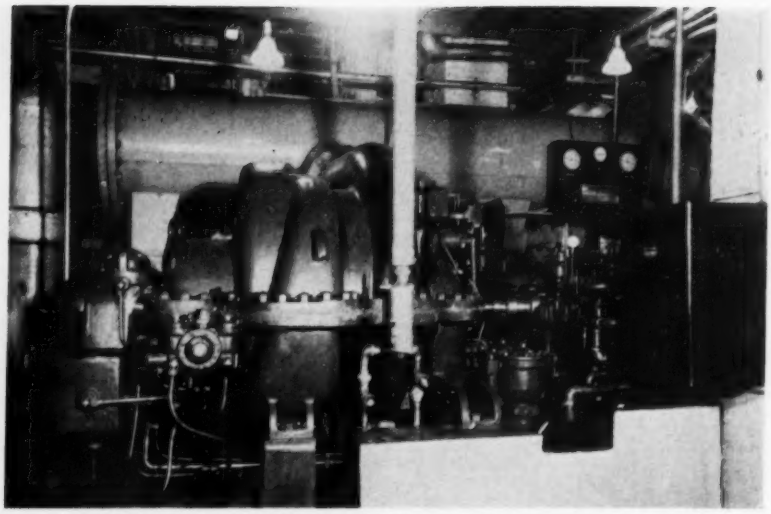
In the cooler months, when lake water temperatures are low enough to handle the bath cooling job, the compressor can be cut out of the circuit. The summer to winter change-over from the compressor-chilled water to city water is simple. All that is necessary is the opening of one manual gate valve, and the system is ready to operate on city water. Temperatures in the tanks are controlled automatically whether city water or water chilled by the compressor is being used.

A built-in capacity control system adjusts the compressor's output and power consumption to the amount of cooling required in the bath. Thus, if only two or three barrels are being used in one of Great Lakes' tanks, the bath cooling load drops and the compressor capacity automatically steps down. The compressor therefore supplies no more cooling and uses no more power than is required by the plating bath.

The cooling coils used in the tanks are of the plate type. They are placed in neutral zones in the tanks to prevent their picking up stray currents and interfering with the plating process. Water supply and return pipes are insulated to prevent currents from travelling to the compressor from the tank.

This new bath cooling system, designed by the Belke Mfg. Co., promises to be equally effective with any zinc, cadmium or white brass plating bath. With certain modifications, it could be adapted to bath cooling in anodizing, electrolytic pickling and other similar processes. Actually, wherever bath temperatures must be held between 45 and 90 F, a similar system could be effective.

WHEN BEDROOMS at New York's Hotel Commodore were air conditioned, the work was carefully scheduled to keep rooms in use



A CENTRIFUGAL WATER COOLING system having 525 tons of capacity supplies refrigeration for ballrooms, meeting rooms, dining rooms, the lobby, etc., as well as providing extra capacity which is used for air conditioning the guest rooms on the 5th and 6th floors

Hotel Air Conditioning Planned

. . . . . carefully so minimum number of bedrooms would be out of service at the Commodore in New York

By H. B. Matzen
The Frank A. McBride Co.
Engineers and Contractors

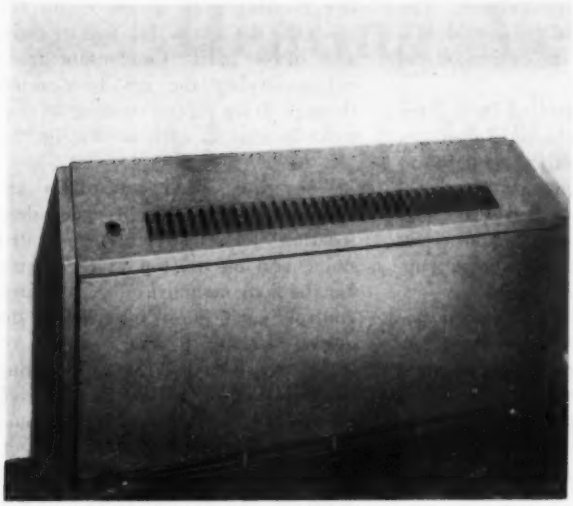
THE COMMODORE hotel — adjacent to Grand Central Terminal, in New York City — realized the importance of providing comfort for attracting large groups, such as conventions, and decided immediately after the end of World War II to start a program of air conditioning.

Air conditioning had already been provided for the coffee shop, bar and cafe, and Oak Room. It was planned to condition the main, east and west ballrooms and seven private meeting and dining rooms all located on the same floor; the main dining room, which is known as the Century Room, the cocktail lounge and the main lobby.

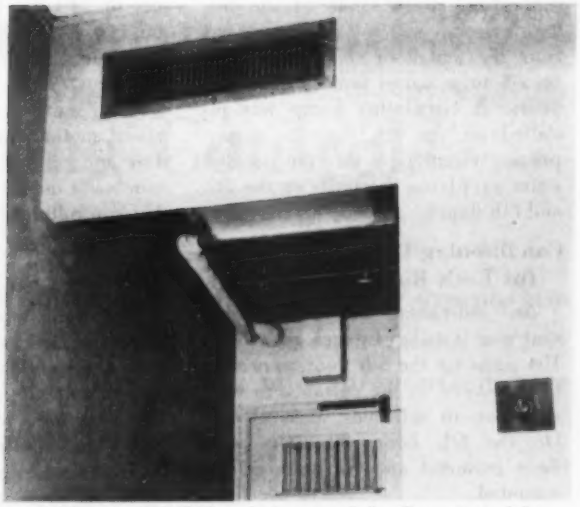
Due to the fact that the Grand Central Terminal tracks are below the building, leaving but a small triangular area for the engine room, it was decided to install the largest possible chilled water cooling plant to take care of the above-mentioned air conditioning, and as much expansion as possible. A centrifugal water cooling system having a capacity of 525 tons of refrigerating effect was installed.

The calculated full load for supplying chilled water for the main, east and west ballrooms, seven private meeting and dining rooms, Century Room, cocktail lounge and lobby was 466 tons. However, since all of these areas are not fully occupied at one time, a load factor of 80 percent was decided upon, so that there was a reserve of 152 tons available for expansion.

Due to the success resulting from air conditioning these spaces, it soon became evident that additional air conditioned meeting rooms were necessary. In order to provide these rooms it was decided to convert the first bedroom floor. This was done by removing the partition between two adjacent bedrooms, and converting them to one large room. In this way 33 additional air conditioned rooms were added, which can also be used for guest rooms.



IN THIS GUEST room, conditioning unit is on floor



HERE, A CEILING unit is concealed. Control at right

Also Decided to Air Condition Bedrooms

A study was also undertaken to provide air conditioned bedrooms. The 5th and 6th floors were decided upon, since the 5th floor corridor ceiling was already furred, and in which were located heating, hot water and cold water distribution mains; and also since these two floors would provide the maximum number of air conditioned rooms per floor and required repainting and refurnishing anyhow.

It was stipulated that during installation a minimum number of guest rooms were to be out of service. Since the major portion of the work to be performed was on the 5th floor, it was decided to divide this floor into seven sections, and to complete all work in each section before starting work in the next section.

This was done by installing barriers of plywood at the ends of the corridors at each section, with doors provided in them for passing of men and materials. The corridor carpets in each section were removed and the furniture and carpets in the guest rooms moved to one side and covered with cloths. Two rooms were stripped in each section for use of the mechanics and for tools. All men and materials were brought to and from the 5th floor by service elevators, and the service elevator corridor was used to store only such material as was necessary for immediate use. The air conditioning units were held in a storage warehouse and removed as needed. The bulk of piping was stored on the roof of the building, and a room was provided off the service elevator corridor for storage of fittings in bins, which room was also used as an office by the job superintendent and trade foremen.

The furred ceiling in the guest room corridor on the 5th floor was removed and then re-installed after the completion of the section. In some cases the ceiling mounted units are exposed, and in other cases they were furred in.

Schedule for Each Craft Adopted

Based on the experience gained by work performed in the first section, a schedule of performance for each craft was developed and adhered to. All work necessary to be performed in each section required not more than 30 working days. The maximum number of rooms per section out of service at one time on the 5th floor did not exceed 17. The work performed on the 6th floor consisted of cutting holes through the floor of each room for chilled water supply and return piping and drain piping, connecting the piping to the 5th floor mains, setting the units, final piping connections at the units, insulating and installing the electrical wiring and making connections to the motors and three speed motor control switches. Not more than three bedrooms on the 6th floor were out of service at one time.

Chilled water supply and return

PERFORMANCE AND other data for the 400 cfm ceiling mounted units

Room	A	B	C	D
Cfm, total	300	400	400	400
Cfm, outside	60	60	60	60
Total Btu	6000	8000	10000	11100
Room sensible Btu	3780	5400	7000	7880
Total sensible Btu	4760	6380	7980	8860
Total latent Btu	1240	1620	2020	2240
Water in, F	47	47	47	47
Water out, F	59	59	59	59
Room D.B., F	80	80	80	80
Room R.H., percent	50	50	50	50
Outside air D.B., F	95	95	95	95
Outside air W.B., F	75	75	75	75
Leaving air D.B., F	68.4	67.6	64	62
Leaving air W.B., F	62.6	62.3	60.7	59.8
Gpm water	1.0	1.33	1.67	1.85
Water friction, ft	0.8	1.3	1.9	2.3
Coil face vel., fpm	225	300	300	300
Filter vel., fpm	162	216	216	216
No. rows coil	4	4	4	4
Motor, hp	1/30	1/30	1/30	1/30
Fan dia.	5¼	5¼	5¼	5¼
Approx. wt., lb	110	110	110	110

Coil size ..... ⅜ O.D. Cu tubes 8 x 24 9 fins/in. 1.33 sq ft
Filter ..... Washable type 28 x 9½ x 1
Fan ..... D.I.D.W. Alum
Motor ..... 115/60/1 — 1050 rpm — resilient mount — double shaft ext. opened-shaded pole

connections were made at the 5th floor risers, which were extended from the 2nd floor ceiling and connected to a surge tank on the 7th floor. A circulating pump was installed on the 5th floor to assure proper circulation of the chilled water supplying the units on the 5th and 6th floors.

Conditioning Unit for Each Room

An individual air conditioning unit was installed in each room. All 104 units on the 5th floor were ceiling mounted in the entrance to each room or in adjacent linen closets. On the 6th floor, 32 units were floor mounted and 59 units ceiling mounted.

Each unit was connected to the outside corridor for an outside air connection of 60 cfm. The remainder of 340 cfm is recirculated. The 60 cfm taken from the corridor is exhausted through the bathroom exhaust.

Each unit is controlled by a three speed motor control, high, medium, low and off. No other temperature control is used other than the control for controlling the chilled water supply at the main chilled water circulating system. This water is supplied at a maximum of 47 F.

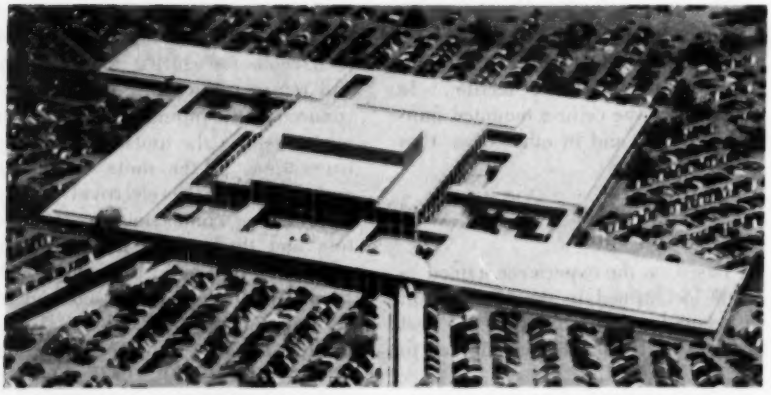
The water supply and return system was designed to provide a balanced system for each of the seven sections or zones. Balancing valves at each unit properly balance the water in circulation, and also provide a simple means of venting and draining each unit.

Each unit is equipped with removable washable air filters and drain pan, and enclosed in a decorative housing with access doors for servicing the filters, fan motor, coils, and drain pan. Condensate from dehumidifying the air is drained through drain piping running to slop sinks located in each section on the 5th floor.

The three speed controllers are mounted on the wall at a convenient location for the ceiling mounted units, and on the top of the casing for the floor mounted units. Through control, each guest may select the degree of comfort he desires.

The total cooling load, including the first bedroom floor and the 5th and 6th bedroom floors, is 643 tons; however, the assumption of 80 percent load factor has proved correct, since the original installation of 525 tons has been sufficient to provide the necessary chilled water under maximum operating conditions.

"BIGGEST COOLING MACHINES" FOR GIANT SHOPPING CENTER



NEW AIR CONDITIONED shopping center is shown by this model. Chilled water will be circulated through underground mains to each of the buildings, will be metered to tenant buildings for air conditioning

THE "BIGGEST COOLING machines ever designed for air conditioning a business building" are being built by Carrier Corp. for installation in the world's largest regional shopping center, now under construction in the Detroit area, Cloud Wampler, Carrier's president, announced recently with the signing of a $1,414,000 order for the installation.

The project is the $20 million Northland Center regional shopping development being built by the J. L. Hudson Co., one of the nation's leading department stores and the second largest department store in the world.

Mr. Wampler said that the two giant centrifugal cooling machines will provide 3600 tons of cooling capacity. The machines — 11 ft high by about 14 ft wide and 20 ft long — will handle air conditioning requirements for all of the buildings currently under construction in the 161 acre Northland Center project, at Eight Mile and Greenfield Roads and Northwestern Highway.

Now rising is the central Hudson store of three floors and basement, totaling about 10 acres of floor space, plus five additional one-floor buildings which will house 70 tenant stores and restaurants. Total floor area is nearly 1 million sq ft.

Chilled water from the centrifugals will be circulated through underground mains to each of the buildings in the project and will be supplied to tenant buildings for their air conditioning use on a metered basis.

The air conditioning system for the Hudson store itself will use an ultra-modern high pressure system recently perfected for department stores. It involves the biggest air conduits ever fashioned for this purpose.

Thirty-two wheels ranging from 1 ft to nearly 6 ft in diameter will distribute nearly half a million cfm of conditioned air. The air will pass through nearly 11 miles of conduits and ducts for distribution to the conditioned areas.

Another 11 miles of chilled water tubing will be used in cooling coils to remove excess moisture and cool the air.

The interest in air conditioning this year, plus large industrial contracts, are pushing Carrier Corp.'s sales to record levels, Mr. Wampler said. Latest figures, for the 12 months ended October 31, showed sales of nearly $108 million, compared with $81 million for the 1951 fiscal year.

Heating, Ventilating and Air Conditioning Controls

. . . . were the subjects of an all-day symposium sponsored last month by the Instrument Society of America's Chicago section and summarized here

THE INSTRUMENT SOCIETY of America's Chicago section made "its first venture" into the subject of heating, ventilating and air conditioning last month with an all-day-Saturday symposium held in the meeting rooms of the Western Society of Engineers. Registration was "better than expected" and the interest shown was quite gratifying to the ISA.

There were six speakers — three in the morning and three in the afternoon — with a luncheon for the group between the sessions.

Control Instruments at Argonne Laboratory

Robert W. Van Valzah, operations engineer, operations division, Argonne National Laboratory, Lemont, Ill., discussed the application, operation and maintenance of heating, ventilating and air conditioning control instruments at ANL, a research laboratory carrying on various experimental and development projects in connection with the atomic energy program. The following paragraphs summarize parts of his talk.

One rather unusual ventilation requirement at ANL is the protection of scientific personnel against the hazard of toxic chemical fumes and radioactive particulate matter. Because of this, the standards maintained for the functional operation of the ventilating systems are unusually rigorous, he said.

The ventilation facilities provided in the chemistry building, for instance, demonstrate the degree to which this has been accomplished. All laboratory areas devoted to radio-chemistry are fully air conditioned. The air supply is filtered to remove a high percentage of the dust particles and none is recirculated. All lab exhaust air is prefiltered and then passed through high efficiency filters before being discharged to the atmosphere.

The air supply system furnishes conditioned air for scientific purposes during the non-heating season and tempered air during the heating season to the offices, corridor and laboratories of the six standard laboratory wings. Each wing has its own cooling coil connected into the central chilled water system. A central refrigeration unit cools the water which is pumped to the various cooling coils in each wing. Each supply system consists of an outdoor air intake, filters, preheat coil, two fans, cooling coils, reheat coils, pneumatic controls and duct work to the offices, corridor and laboratories.

System Divided Into Three Branches

The system is divided into three separate branches, each starting from the main plenum after the fans. The first main branch supplies a constant volume of air to the offices and corridor, the second main branch supplies a constant volume of air to the laboratories and the third main branch supplies a variable amount of air to the corridor. The first and third main branches are brought to the centrally located core area of the wing where they rise to the main floor above the hung ceiling in the corridor and extend in both directions to the ends of the laboratory wings. The office and corridor supply duct has a branch to each office at 5 ft intervals. This branch also has ceiling diffusers spaced 40 ft apart in the corridor. The variable air supply duct also has ceiling diffusers spaced in between the corridor diffusers 10 ft apart along the corridor. The second main branch extends the entire length of the service floor with individual branches or risers spaced 10 ft apart extending to the laboratory spaces and terminating in ceiling air diffusion panels. Space is provided in the individual branches for the addition of booster heating and cooling coils, for laboratories which have special air conditioning requirements.

Air from the offices is vitiated to the corridor; the corridor air and the vitiated office air is vitiated into the laboratories; this air with the laboratory supply air is picked up by the laboratory exhaust system and discharged to outdoors by means of exhaust fans in the fan loft. Whenever the laboratory exhaust air demand is greater than the minimum of the air supply, the extra supply air is provided through the variable air system which, as mentioned before, discharges into the corridor and is vitiated to the laboratories.

Use of Static Pressure Regulators for Control

The supply system is operated mainly by automatic pneumatic controls. The two supply fans are manually started and stopped by pushbutton switches which energize the electric pneumatic relays for po-

sitioning the vortex dampers to whatever opening is dictated by the static pressure regulator with its sensing tip in the plenum after the fans. A motorized damper in the variable air branch is modulated open as governed by the corridor static pressure regulator, which has one sensing tip in the main floor corridor and the other in the service floor. A slight negative pressure, 0 to 0.01 in. w.g., is maintained in the corridor. An exhaust hood demand for more than the minimum supply as determined for air conditioning purposes will tend to decrease the air pressure in the corridor. The corridor static pressure regulator senses the drop in corridor pressure and actuates the variable air motorized damper so that more air will flow to the corridor. This action lowers the discharge plenum static pressure but the plenum static pressure regulator will modulate to a more open position to maintain the set pressure in the main plenum. When the excess air demand is reduced, the corridor static pressure regulator senses the rise in corridor pressure and the motorized variable air damper is positioned closed. In turn, this rise in plenum pressure is sensed by the plenum static pressure regulator and the vortex dampers will modulate to a more closed position.

An insertion gradustat in the plenum after the fans modulates the preheat valve so as to maintain an air plenum temperature of approximately 50 F. A wet bulb master gradustat in the outdoor air plenum resets the dew point stats, with respect to the wet bulb temperatures, so that at a wet bulb temperature of 65 F the control point of the dew point stats is 54 F and at a wet bulb temperature of 75 F the dew point control is reset to 63.5 F. The dew point gradustats modulate the three-way valves in the chilled water supply so as to maintain the discharge air temperatures from the cooling coils as outlined above.

A dry bulb master gradustat in the outdoor air plenum resets the control points of the room submaster gradustats with respect to the outdoor air temperature so that at 70 F outdoor temperature the control point of the room submaster stats is 70 F and at an outdoor temperature of 95 F the control point is reset to 85 F. The submaster gradustats for their respective zones (offices, laboratories and corridor variable) modulate the reheat valves directly as in the case of the variable air or through averaging relays connected to thermostats in the other two zones so as to maintain the desired space or discharge air temperature.

Room gradustats control the booster heating and cooling coil combinations which are inserted in the individual branch runouts, in the service floor, from the main laboratory air duct to the laboratories requiring special air conditioning.

Handling Exhaust from Laboratories

The majority of the laboratory spaces are provided with hoods which exhaust radioactive fumes and gases. Great flexibility in exhaust handling facilities is obtained by the large number of relatively small exhaust fans in the fan lofts. On the basis of a 20 ft laboratory, a maximum of four exhaust fans may be utilized or a minimum of one. Two exhaust air paths are available for each 10 ft of laboratory space. The number of hoods in the laboratory determines the number of runouts or exhaust air paths utilized.

The runouts in the laboratory go up to the fan loft where they discharge into the dirty plenum. Between the dirty plenum and the clean plenum there are high efficiency filters. The exhaust fans are connected to the clean plenum and discharge the air out through stacks approximately 5 ft above the fan loft roof.

Wherever radioactive hoods are used, a laboratory bypass duct from the dirty plenum in the fan loft to a register in the laboratory, is used so that at all times a minimum amount of air can be exhausted from the laboratory. The hoods are provided with air velocity regulators which maintain nearly a constant air flow velocity for any position of the hood door. Thus, the amount of air handled by a hood varies with the hood door position. Air may either be exhausted from the hoods or from the laboratory bypass. Therefore it is necessary to have a controlled motor operated damper for the lab bypass in order to maintain a minimum exhaust from the laboratory.

The exhaust runouts in laboratories with radioactive hoods are made of round duct sections each 4 ft long with quick disconnect connections.

Plan to Operate Conditioning in Winter

The ventilation system heating is secondary to the primary heating systems of the building. Panel heating is provided in the floors on the lab side and there are convectors below the windows on the office side. An outdoor stat regulates the temperature of the water and starts and stops the hot water pump. The solar heat load during the intermediate weather, along with the building thermal lag, has given some difficulty since the air conditioning system is not operated during the winter months. Some cooling is attained by the ventilation system without chilled water if the hot water temperature range is widened toward the low limit and the pump starting temperature is lowered. With no call for heating by the reheat coils, air at approximately 55 deg from the preheat coils may be delivered into the rooms for limited cooling purposes.

Internal heat release loads within the laboratories have been a cooling as well as an overheating problem. The former is a matter of the cooling facilities provided and the latter is a matter of winter operation of the cooling system. Plans are now in progress for providing winter operation of the air conditioning system. The hot water heating controls are standard and in general have not been troublesome.

Periodic Tests Assure Proper Operation

There is only one way to be sure of proper operation and that is by periodic tests. The filters in the supply and exhaust systems have to be checked periodically for pressure drop and an operating procedure has been set up for changing them on this basis. The hood face velocities are checked at the same time the hood prefilters are tested for pressure drop, a hot wire anemometer being used for this purpose. Other instruments used under the testing program are draft gages, pressure regulating gages, vane anemometers, pitot tubes, pyrometers, manometers, thermometers, sling psychrometers, recorders, speed counters, volt-am-

meters, etc. The ventilating control men should be capable of using these instruments in order to detect nonperformance of the equipment. The supervisors of the control men generally direct the application of these instruments. In case of real difficulty or necessity of alterations the matter can be referred to an operating engineer for solution. Daily logs of the operating conditions are kept around the clock.

A preventive maintenance program is scheduled at Argonne. The air conditioning equipment is gone over during the winter time and the heating system is gone over during the summer time. Spare parts and replacements units are carried in stock for the controls in case of failures. The equipment at Argonne has not been in service a great length of time so that failures and replacements have not been extensive to date.

Draft Control for Heating Boilers

Dale H. Cook, of the Perfex Corp., discussed draft control systems for oil burner installations in his talk at the symposium. He said that progress in mass production techniques has made possible equipment for smaller installations to maintain constant draft conditions in the firebox. These draft control systems will, very frequently, save more than their cost in the first year of operation on oil burners with a fuel input of 10 gal per hr or more, he said. Such savings and other advantages are particularly important because of higher fuel costs and smoke and air pollution ordinances.

A person can hear a wristwatch ticking that has its hands broken off, but he cannot tell what time it is. So it is with the boiler. Without various gages to indicate operating conditions, the operating engineer only knows that it is running, he pointed out.

There are many benefits to be derived from the maintenance of a constant draft condition in the firebox through the use of automatic overfire draft controls. Once a stable overfire draft condition is provided for all firing rates, it becomes possible to do a much better job of making the fuel and air input adjustments. Thus, smoking is reduced or eliminated; a higher CO_2 may be achieved for all firing rates; the burner adjustments will be found to be more stable and, hence, requiring less maintenance and the pilot burners and pilot safety controls will become more stable, resulting in fewer unnecessary shutdowns.

Where forced draft firing with a plus pressure maintained in the firebox is used (as is often the case with boiler-burner "package" type steam generators) on installations connected to tall chimneys, it has proven well worthwhile many times to provide available draft controls for the maintenance of a minimum amount of negative pressure, or draft, at the boiler exit for all firing rates and the usual wide variety of weather conditions. This is accomplished by connecting an actuator to a turn damper in the breeching and connecting the draft control into the breeching at the boiler outlet. Setting the draft control to maintain a negative pressure at the boiler outlet of not more than 0.05 in. H_2O will make possible more efficient settings of the fuel and air input adjustments for all firing rates, resulting in lowered fuel consumption and operating costs.

Some Savings Which Have Been Made

It isn't always easy to factually evaluate the savings which may rightfully be attributed to overfire draft controls, since it is difficult to find installations where only these controls were added and no other changes were made. However, there are such cases. For example, the Harry S. Manchester, Inc. department store in Madison, Wis., installed two sets of overfire draft controls for their two oil fired boilers at an installed cost of less than $800. As a result, they saved over $1800 in their fuel oil bill alone in less than one year.

Similarly, the Acme laundry in St. Louis installed a set of overfire draft controls for a cost of less than $400. During the first year of operation of these controls, a saving in fuel oil alone amounting to over $1400 was realized.

Then, too, the Hartford, Wis., municipal power plant saved over $3000 in fuel alone the first year or a saving of approximately 14 percent after installation of overfire draft controls. Also, the Columbia hospital in Milwaukee showed a saving of over $1000 per year in the fuel bill alone after installation of overfire draft controls in their boiler room in addition to enjoying many other benefits.

[Other talks given at the symposium will be summarized in another issue.]

ELECTRONIC "NOSE" FINDS PIPING LEAKS

A "NEARLY FOOLPROOF" method of finding leaks "in anything from a football to a complicated coil of pipe or a huge distillation tank" has been developed with the gas that once served only as "the cold-making agent in refrigerators", says E. I. du Pont de Nemours & Co.

Use of "Freon-12" as a leak detector stems from its ability to seek out and escape through the finest openings in almost any material. The exact location of such leaks can be found quickly with an electronic device or a gas-burning torch whose flame changes color in contact with the nonflammable "Freon".

One application is the testing of complicated pipe coils or pressure vessels too large and cumbersome to be filled with compressed air and dunked in a liquid bath where escaping bubbles would indicate leaks. Today, manufacturers carry out tests on tanks as high as a two-story building by filling them with a mixture of "Freon" and air, then carefully inspecting likely leak points, such as joints, fittings, or welds, with one of the electronic "noses".

With the increasing use of radiant heating systems, the small, portable "Freon" detector is finding its way into the tool kit of the heating contractor. Instead of actually placing the heating system in operation to test its tightness, contractors are using the electronic "sniffer" to give a safe and reliable "dry" test as soon as the piping is in place.

52,060 MILLION THERMS GAS SALES IN 1952

FOR THE 12 MONTHS ended December 31, 1952, utility gas sales aggregated 52,060 million therms, a new peak in total utility sales, according to the American Gas Association. These sales were 8.2 percent higher than in the previous corresponding cumulative period.

ANYTHING CAN HAPPEN

Guard Against Pump Accidents Caused by Loss of Load

• Almost anything can happen when you're in the engineering or operating or contracting (or sales) ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss practical problems that need solving — and ways to solve them.

ACCIDENTS TO turbine driven pumps frequently begin with a loss of load. When the turbine load is suddenly dropped, an upward surge of speed follows. If the speed limiting controls fail to operate quickly in the emergency, the pump and turbine suffer damage from overspeed, and may explode.

An accident of this kind occurred to a turbine driven boiler feed pump at a generating station when, during a period of fluctuating suction pressures, the pump became vapor bound and lost its load. The engineer, who was in the main turbine room on the floor above, heard the pump overspeed and then trip off as the emergency governor closed the throttle. He went to investigate the trouble, but by the time he reached the pump it was running at high speed in reverse and vibrating badly. Realizing that reverse operation was due to water backing through the feed line from the boiler, he closed a stop valve in the pump's discharge line and brought the unit to a stop.

Undoubtedly, the engineer's quick action saved the unit from complete destruction but, even so, the turbine governor had been wrecked by reverse overspeed, and internal parts of the pump had been damaged. Vibration of the unit had been so severe that insulation was shaken loose from piping connected to it.

Reverse flow through the feed line had occurred in spite of the fact that there were two check valves in the line. These were examined after the accident and it was found that both had hung up as the result of heavy deposits of scale.

Foot Valve Leakage Causes Accident

Leakage at a foot valve is believed to have caused loss of prime that resulted in overspeed destruction of a turbine driven unit used for pumping cold water at a paper mill. The pump, in this case, was used for suction lift and was automatically controlled. It ran intermittently, operation being regulated by pressure of water in the system. An overhead tank and a foot valve were used to maintain pump prime during idle periods.

On the day of the accident, the foot valve apparently leaked or hung open and drained the tank. Thus the prime was lost and, on its next automatic start, the unloaded pump raced to destruction. The shafts of the turbine and pump were broken and bent and all other internal parts were damaged beyond repair. The turbine governor flew apart in the accident and the reason for its failure to control the speed of the unit could not be determined.

Prime Lost When Water Supply Fails

In another loss-of-load accident, a turbine driven boiler feed pump was wrecked as a result of a plugged raw water intake pipe. Failure of the raw water supply caused the feedwater heater to run dry and the pump lost its prime. Overspeeding resulted, and all working parts of both ends of the unit were broken. Due to the excessive speed, the turbine wheel was stretched 1/16 in. oversize at the hub, and the coupling between the turbine and the pump exploded.

As in the preceding case, the governor was badly damaged in the accident and the cause for its failure to act in the emergency could not be determined. However, examination of the control valve seemed to indicate that it might have become stuck in the open position due to deposits on the stem — not an unusual cause for turbine overspeed accidents.

How To Prevent Such Accidents

Factors that can cause a sudden loss of load or loss of prime should, of course, be given serious consideration when planning the location of a pump and its piping hook-up; and the pump maintenance program should include special care of valves that might cause loss of prime by their failure. But, since the load may be lost in some unexpected manner, the surest means for preventing overspeed accidents from this cause is to maintain speed control devices in top condition.

Speed limiting governors and their valves are seldom called upon to function, especially on pumps controlled by pressure governors. As a consequence of their inactivity, linkages, stems and other moving parts of the mechanism may become fouled with dirt or rust, and may stick when called upon to act in an emergency.

Only by regular and frequent maintenance and by testing moving parts to see that they operate freely throughout the full length of their travel can speed limiting devices be counted upon to act quickly enough to keep the turbine speed under control when the pump suddenly loses its load.

[Republished by special permission from The Locomotive of The Hartford Steam Boiler Inspection and Insurance Co.]

KEUFFEL & ESSER CO.

SAM LEWIS' PAGE

"Occasionally I Find Time To Do a Little Thinking"

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems

I FIND TIME occasionally to do a little "miscellaneous thinking." I hope that some of my friends and readers will find at least a few of my comments either enlightening or entertaining.

Consider the Scotch Marine Boiler

Consider the relatively modern adaptation of a scotch marine steam boiler for general heating service. The older shipboard boiler of this kind was relatively fat and short. It had a large diameter and often had several internal combustion chambers that were corrugated to aid in resisting the exterior pressure. The outer shells of high pressure boilers of this kind necessarily had to be exceedingly thick to resist the interior pressure, and usually the back end — against which the blast of hot gases must impinge — was water-cooled. The wet back probably was the weakest part of the boiler, since it must have flat surfaces that required a maze of staybolts and braces.

The modern package boiler, adapted especially to burning oil or gas, tends to be long and thin — rather than short and fat, like its shipboard ancestor. The wet back seems to have been replaced by a refractory lined back, and the shell thickness — even for high pressure steam — has assumed a more reasonable dimension. The combustion chamber is too small in diameter for the grates and ashpit for burning coal, but allows acceptable temperature and chemical conditions for liquid or gaseous fuel, provided that mechanical draft is used. This draft may be by a fan that pushes air into the furnace, or by a fan that — by pulling out the gases — invites entry of the air necessary for combustion.

An outstanding feature — presented by many manufacturers of these boilers — is to include the boiler feed pump, the water level control arrangements, and the oil and air preparation and delivery devices, all mounted and piped and wired on the boiler chassis.

I Think We Need Some Safety Factors

A mechanic can employ a rule or a square to measure a board or a pipe and can be assured that the board or the pipe, cut off after this measurement, will fit.

An engineer can compute, using standards acquired by experience and research, the refrigeration demand for cooling a room. He must assume, however, certain conditions of occupancy, air leakage and exterior weather. These conditions are not stable or permanent but must vary from hour to hour throughout each season, and are not susceptible to exact measurement.

This variability in the demand for heat supply or for heat removal seems to me to require a safety factor. Of course, some temperance in the amount of the safety factor is justified, but I would not deduct the computed heat to be removed by the surface of the drinking water cooler from the heat to be expected from the surface of the coffee percolator.

There has been published a plea by one engineer for reduction in the safety factor. He would deduct from the radiator output the heat to be expected from risers and runouts to radiators. He would deduct from the heat to be supplied that to come from the warm bodies of the people in the room. He would deduct, from radiator surface allowances, the heat that could come from the electric lights in the same room. Cognizance of such heat sources is conventional when computing refrigeration for summer cooling, but I am too conventional to reduce the heat demand safety factor for winter heating. I recognize, of course, that in many buildings there are rooms remote from the heat-losing outside walls. Such rooms will be warmed by the electric lights when these lights are in use, even on an extremely cold day.

I Like the Term "Fail-Safe"

An industrial engineer has suggested wider use of the term "fail-safe." I like that term. We could employ it more frequently. It is like the deadman's switch sometimes provided on locomotives. A thermostatically controlled valve should "fail-safe." If safe means open, the valve should close by compressed air or by an electric motor — but should open with great reliability, as by springs or counterweights, if the compressed air or electric supply should fail.

CO_2 Is Pretty Useful Stuff

Carbon dioxide, the gas that follows imperfect combustion, tickles a nerve in our windpipe and regulates the rate at which we inhale or exhale. It is the gas that makes champagne corks pop and that enlivens the charged waters that — with "flavoring" of some kind added — we drink.

If we squeeze CO_2 gas into a container until it gets warm and if we

then pour water over the container to cool the gas, eventually the gas becomes a liquid. Then, if the liquid is allowed to expand, it becomes a gas again, provided the heat necessary to change its state can be obtained. Carbon dioxide employed in this manner is a safe, and often-employed, refrigerant for air cooling, food preservation, etc. It has served on shipboard in the Gulf of Mexico to keep bananas from premature ripening.

Carbon dioxide in its liquid state is a readily handled refrigerant in many industries, and in the form of dry ice this material protects ice cream indefinitely, without any corrosive brine drips, such as follow the ice-salt combination. Corrosive brine, dripping from railway refrigerator cars, is a major problem in maintaining steel bridges.

Carbon dioxide dry ice, sprinkled by airplane above the clouds, has been proved to start condensation of vapor into much needed rain and snow.

In one special research project, where an air temperature of minus 50 F is provided in a large enclosure, the direct expansion or evaporation of carbon dioxide liquid as a refrigerant in a jacket around the air enclosure was a simple process. To accomplish comparable results with ordinary refrigeration would have involved cascading or multi-staging two compressors.

Pretty useful stuff, this CO_2, even if we must wear gas masks when we try to stay too long in too high concentrations of it!

Operating Low Temperature Refrigeration System

J. H. SHAW's comments in the February HPAC regarding my article in the January issue are welcome. I appreciate the opportunity to answer some of his questions because it gives me a chance to elaborate on a few of the items which may be of interest to other readers. I will attempt to answer Mr. Shaw categorically as follows:

1) The calcium chloride brine, used in the refrigeration system at the aeroballistics research area at the Naval Ordnance Laboratory, is maintained at a temperature of 22 F, specific gravity of 1.190 and a pH value of 7.5 to 8.

Corrosion is controlled by the use of sodium bichromate. No problems due to corrosion have been observed since the system was put into operation 4½ years ago.

Three Reciprocating Compressors Used

2) The low temperature "Freon 22" system mentioned in my article is three stage using three reciprocating compressors, motor driven with a combined total of 120 hp. A hermetically sealed liquid circulating pump discharges a constant supply of liquid refrigerant to the evaporator coils. The pump is located in a surge drum at the base of the evaporator coils. A small percentage of the mixture of "Freon" and oil that is discharged from the liquid pump bypasses the evaporator coils and is expanded into a double pipe oil still. The separated oil then flows into an oil receiver and is accumulated for re-use.

Float valves in the compressor crankcase maintain the proper oil level and each compressor is equipped with an oil cooler. An oil separator is located in the discharge line of the high stage compressor.

Included in the balance of the refrigeration equipment using "Freon 22" are 14 low temperature laboratory units with capacities varying from 8 to 18 cu ft. The only provision for oil recovery is the use of an oil separator in the discharge line of the compressor. The oil is returned to the compressor by means of a float in the oil separator.

The relative immiscibility of "Freon 22" and oil at low evaporating pressures has not presented operating difficulties in the refrigeration units at NOL. This is probably due to the use of either dry expansion or heavily loaded flooded evaporators resulting in greater ebullition and causing the oil and refrigerant to mechanically mix. The oil return is then similar to a "Freon 12" system.

The Cascade System at the Laboratory

3) The "Freon 12" cascade system at NOL consists of a multistage centrifugal compressor and four reciprocating compressors, motor driven with a combined total of 350 hp. Methylene chloride brine is circulated at −114 F at the lowest box temperature. The use of technical grade methylene chloride and dry (oil pumped) nitrogen together with a comparatively small ratio of volume of circulated brine to evaporator coil area, minimizes the problem of an excessive amount of moisture freezing out of the brine at evaporating temperatures.

There are, however, as pointed out by Mr. Shaw, many pitfalls to beware of when using methylene chloride, and chemical tests are constantly made to obtain data to ward off future trouble.

One of the problems encountered in this system has been the difficulty of locating a suitable packing for the brine pumps, with the result that double mechanical rotary seals have recently been substituted.—C. E. MANDLEY, Quarterman in Charge, Refrigeration and Air Conditioning, U.S. Naval Ordnance Laboratory, White Oak, Md.

COMMON-SENSE BEST ANSWER TO PIPING PROBLEMS

JOHN A. HOLBROOK's remarks in the January HPAC on piping problems are appreciated. Although extremely brief, they touch on the practical side of a piping system.

The subject of versatility in a piping system is so complicated and contains so many variables dependent on equipment costs, use factors, product costs, etc., that an attempt to tie any engineer down to flat all-inclusive statements is not at all practical and would only start a controversy. Common-sense, together with a little engineering know-how, usually is the best answer to problems of this kind.

Mr. Holbrook appears to have demonstrated this in his brief words based on his experience.—J. H. SHAW, Eastman Kodak Co.

QUESTION OF THE MONTH

IF YOU DON'T HAVE the answer to a problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange," where questions on heating, piping and air conditioning are asked and answered. You are invited to contribute a question for publication, or an answer to a published question. . . . . Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

SUMMARIZES FEATURES OF STEEL HEATING BOILERS

IN ANSWER TO THE question published in the February HPAC, we believe that the choice of a "conventional" or a "packaged" boiler must be made by the individual who is responsible for the particular job, after taking all characteristics of both types into consideration.

The matter of rating is an important factor, we feel. All steel heating boilers are rated on the basis of the Steel Boiler Institute's code, which means that all catalogs must show the minimum heating surface, furnace volume, and furnace height.

The design advantages of steel heating boilers may be summarized as follows:

1) They can be fired with any available fuel: oil, gas, coal, (either hand fired or stoker fired), or wood.

2) They can be conveniently changed from one fuel to another as conditions demand.

3) They can be easily cleaned from both the fire and water sides of the boiler. All tubes are readily accessible through the hinged front flue doors, while soot removal doors are provided in the rear smokebox. All water surfaces can be flushed clean through cleanout openings provided, giving access to all parts.

4) What about space required in the boiler room? Steel heating boilers do take up more space than some other types. But why? Space is largely dictated by capacity, and steel heating boilers will operate at a point 50 percent above their catalog ratings, so they must of necessity be larger dimensioned when compared capacity for capacity.

5) Steel heating boilers are, of course, designed to operate with natural draft. However, they are found operating very successfully from one end of the country to the other with induced draft fans and no stacks.

Now, let's take a look at efficiencies. Here are results of tests run by an independent consulting engineer on three housing jobs at Newark:

1) Seth Boyden Court — One 36,400 sq ft boiler fired with a burner burning No. 6 oil. Overall efficiency 77.3 percent with boiler operating at 125 percent of catalog rating.

2) Felix Fuld Court — One 18,200 sq ft boiler fired with an oil burner. Overall efficiency 77.5 percent with boiler operating at 133 percent of catalog rating.

3) Stephen Crane Village — One 30,300 sq ft boiler fired with oil burners. Overall efficiency 78.4 percent with boiler operating at 127 percent of catalog rating.

Note all of the above tests were run with the boilers operating at 125 percent or more of their catalog rating, and had they been run at catalog ratings the efficiencies would have been 80 percent or more.

A test run on five 42,500 sq ft boilers, fired with oil, installed in the Johnson housing job in New York City, showed 84 percent efficiency at 75 percent rating, 81 percent efficiency at 100 percent rating, and 80 percent efficiency at 130 percent rating.

It should be remembered in connection with these efficiencies that the boiler manufacturer furnished the boilers only, the firing units were furnished by others, the jobs are all natural draft, and the tests were operating tests on the jobs.—JOHN R. COLLETTE, Vice President, Fitzgibbons Boiler Co., Inc.

CITES ADVANTAGES OF PACKAGED BOILERS

A QUESTION PUBLISHED in the February HPAC on when to use "packaged" or "conventional" boilers for heating industrial and other buildings asked for comment on their respective advantages and disadvantages.

The only limitations on the use of packaged automatic boilers are (1) wherever coal or solid fuels (wood chips, bagasse) must be burned, and (2) where pressures exceed about 250 psi.

The modern packaged automatic boiler is compact, light in weight, and efficient. For example, 83 percent is the minimum guaranteed efficiency with one packaged automatic boiler burning heavy Bunker C No. 6 oil through the air atomizing burner.

More and more installations are being made in batteries of multiple units so that any reasonable steam volume can be supplied by packaged unit boilers. The attention, maintenance, and service required are at a minimum with such boilers.

Ease of installation, cleanliness of operation, and minimum space required all have contributed to the popularity of packaged automatic boilers for both heating and process applications.—S. D. DISTELHORST, Orr & Sembower, Inc.

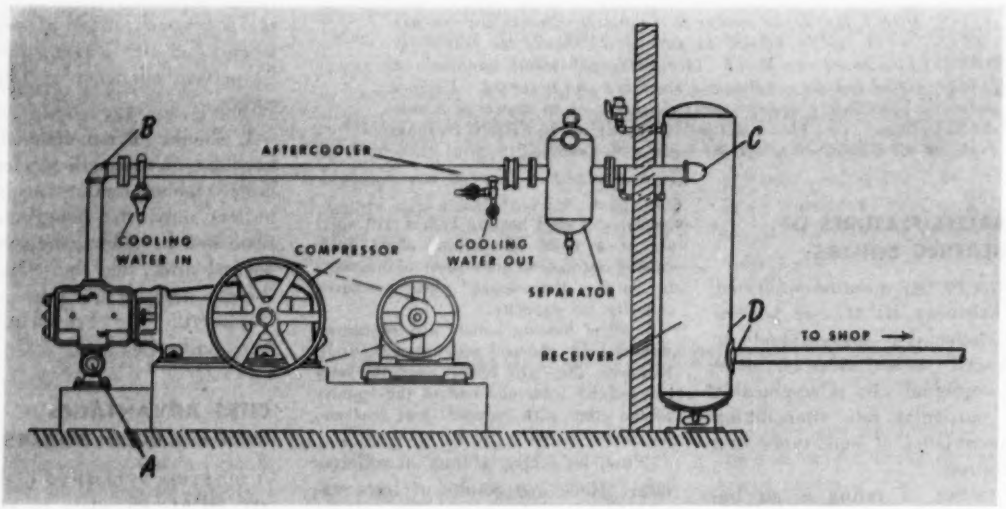
ASKS INFORMATION ON PREVENTING COLD AIR FLOW THROUGH DOORS

"We desire to obtain information on the feasibility of using either compressed air or air circulated by blowers to create a screen effect at large doors of an industrial plant to prevent cold air from rushing in — which makes the working conditions miserable inside the building until the normal inside temperature is again reached.

"We'd certainly appreciate any plans, specifications or other information which could be made available, and would like any figures on horsepower, air pressure, etc."

[You are invited to answer or comment on this question from a reader of HPAC for publication here. Please address your remarks to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.]

• *A towering 20 ton exhaust fan has been installed by The International Nickel Co. of Canada to ventilate the underground workings of the new caving project at its Creighton mine in the Sudbury district of Ontario. The fan is driven by a 350 hp motor weighing 5 tons, ventilates the workings by a flow of fresh air at the rate of 300,000 cfm.*



EFFECTIVENESS OF AFTERCOOLER, separator and receiver in removing moisture from line may be shown by typical example. At point *A*, the compressor inlet, the air is at 80 F, 70 percent relative humidity. 27,000 cu ft per hr carry 29.67 lb per hr of water vapor. At point *B*, water content is same but temperature has risen to 360 F. At points *C* and *D*, air temperature is down to 80 F and water content has been reduced to 5.67 lb per hr. Because temperature at point *D* is normally below pipe line temperature, no further condensation takes place

Compressed Air Plant's Success Depends on Distribution Piping

GENERALLY SPEAKING, the compressed air distribution system is designated as the main pipe line, headers and hose carrying the compressed air to the tools. However, between the compressor and the main line are several system components which should be identified. These components include the aftercooler, moisture separator and air receiver, as shown in the accompanying sketch. Their functions are briefly as follows:

An aftercooler is essentially a heat exchanger for cooling the air discharged from the compressor. It also provides a most effective means of removing moisture from the compressed air. The aftercooler may be horizontal or vertical.

The moisture separator, as the name implies, serves to take moisture from the air. Many designs are available. As further assurance of moisture removal (moisture causes tool lubrication breakdown and excessive wear) traps and drops are built into the piping leading to the points of use.

An air receiver is a storage tank for the compressed air. Some moisture removal is accomplished here by gravity. The receiver serves principally to dampen discharge line pulsations.

Beyond these components is the distribution system. During the layout stage, it is necessary accurately to determine the amount of air required in each section of the plant before compressor size and piping can be selected.

A poorly installed or carelessly maintained distribution system can result in appreciable production losses. The distribution system is, therefore, one of the most important elements of the compressed air plant. In planning it, the following general rules should be observed:

1) Pipe sizes should be large enough so that the pressure drop between the receiver and the point of use will not exceed 10 percent of the

initial pressure. Recommended pipe sizes are shown in an accompanying table.

2) Where possible, a loop system should be used around the plant and within each shop and building.

3) Long distribution lines should have liberal size receivers located near the far ends or at the points of occasional heavy use. Many peak demands for compressed air are instantaneous or relatively very short and storage capacity near such points avoids excessive drop.

4) Frequent outlets should be provided on each header, or main, for attaching hose for air operated equipment. The outlet should always be at the top of the pipe line to prevent carryover of condensed moisture to the tool. Frequent outlets result in shorter hose lengths and, therefore, less pressure drop. Recommended hose lengths are shown in the second table.

5) All piping should be arranged so that it slopes toward a drop leg or moisture trap. This permits removal of moisture before it reaches air-operated devices.

Because engineering the compressor system is vitally important, reference should be made to the Compressed Air Handbook and other sources if a full grasp of the problems and their solutions are to be realized.

[Reproduced by special permission from the booklet, Compressed Air Power in Industrial Production, prepared by the committee on engineering education of the Compressed Air and Gas Institute and published last month.]

PIPE SIZE RECOMMENDATIONS for transmission of compressed air at 80 to 125 psig

Volume of air transmitted (cfm)	Length of run (ft)				
	50-200	200-500	500-1000	1000-2500	2500-5000
	Nominal pipe diameter (in.)				
30- 60	1	1	1¼	1½	1½
60- 100	1	1¼	1¼	2	2
100- 200	1¼	1½	2	2½	2½
200- 500	2	2½	3	3½	3½
500-1000	2½	3	3½	4	4½
1000-2000	2½	4	4½	5	5
2000-4000	3½	5	6	8	8
4000-8000	6	8	8	10	10

HOSE SIZE RECOMMENDATIONS for transmission of compressed air at 80 to 125 psig

Rate of air flow (cfm)	Types of air tools	Recommended hose sizes (nominal diameter in inches)		
		0 to 25 ft long	25 to 50 ft long	50 to 200 ft long
0- 15	screwdrivers small die grinders spray guns ¼″ drills ¼″ rivet hammers light chipping hammers scaling hammers ¼″-⅜″ impact wrenches	5/16	⅜	½
15- 30	2″ grinders 5/16″-1/2″ drills ⅜″ impact wrenches ⅜″ rivet hammers chipping hammers ½-1 hp motors bench rammers	⅜	½	½
30- 60	⅝″-1″ drills ¾″ impact wrenches rivet hammers ½″ and up 4″ grinders light vertical sanders floor-rammers 1-2 hp motors chain hoists	½	¾	¾
60-100	1″-2″ drills 1¼″-1¾″ impact wrenches 6″-8″ grinders heavy vertical grinders 2-4 hp motors	¾	¾	1
100-200	winches 4-10 hp motors cable hoists	1	1	1¼

NOTE: With most air tools the proper size air hose is at least one size larger than size of pipe thread on tool air inlet.

THE LAW AND YOUR PROFITS

Install Equipment to Avoid Foreseeable Injury Danger

EVERY NOW AND THEN, legal opinions can reinforce selling talks to swing customers into line for better installations. An example is the case discussed this month; while it treats of a particular type of heating equipment, the legal point of "foreseeable danger" may be present in many other types of heating, piping and air conditioning installations.

On a winter's day not long ago, Mrs. Doe Z. Doats [all names herein are disguised] entered the ladies' lounge in the Grand City station of the Atlantic & Pacific Railroad accompanied by her 5½ year old nephew and little Divey Doats, her son of 18 months. The exposed heating equipment was quite hot, as it was a cold day.

While Mrs. Doats (true to womanly habit) was gazing into the mirror, she heard her nephew say, "Look at the choo-choo!" and got a glimpse of him picking up little Divey. The mirror reclaimed her attention until the infant screamed. She turned and snatched him from his perch, whereon the nephew had placed him so that he might view the passing train. The tender flesh of Divey's bare legs was severely burned during its brief contact with the exposed heating equipment.

In behalf of their son and in their own right, Mr. and Mrs. Doats sued the railroad for damages. Their case rested chiefly on their contention that the heating installation, "at the time of the accident, was both actually and in legal contemplation, a highly dangerous instrumentality." The Doats family did not allege that the heating system was defective in any way — only that it was hot.

Among the cases cited by Divey's parents were (a) where unattached equipment toppled and injured plaintiffs; (b) where a pressure vessel burst during inspection; (c) where faulty design of a tank caused leakage and subsequent fire. "Most strenuously" the parents argued that a fourth case fitted their own facts precisely: A woman entered a bank and placed her two year old son "upon a smooth mahogany-topped bench" not far from a hot item of heating equipment "and not guarded in any way from contact" with bench sitters. While Mumsy was banking, the child fell onto the hot surface and was burned. The court in the cited case, noting the combination of bench and unguarded hot surface, made the bank pay damages.

Decision Hinged on Possibility of Injury

A majority of the state supreme court did not view these cases as applicable to the Doats affair, because they all hinged either upon *defective equipment* or a reasonably *anticipated possibility* of injury. The defendant railroad was "not bound to anticipate that anyone would deliberately contact a hot piece of equipment which was isolated from the furniture in the room." The court thought it significant that Mrs. Doats "did not anticipate any such action although she observed her nephew lifting the child and telling him to look at the trains."

Sustaining the lower court's decision and holding that the railroad was not liable, the higher tribunal rejected the theory that the heating equipment was a dangerous instrumentality. However, it should be borne in mind that the railroad won this case by a fortunate interpretation of the word "foreseeable". In fact, the dissenting justice in the case reasoned at length against the no-negligence view and in other courts his views might conceivably prevail.

"Water," he reminds us, "boils at 212 F. . . . If the defendants had maintained an open vat of boiling water, and a child had been scalded by water escaping from the vat, there would be no question" of the railroad's negligence. Nor would there be any question of the road's responsibility if the child had been burned by simply brushing against the heating equipment.

The dissenting judge thought Divey's parents should have been permitted to show by expert testimony that in many public places "dangerous" heating equipment is suitably covered or equipped with safety guard rails, and that in this case the equipment could have been well protected at a "trifling expenditure". He does not agree that heating equipment "must perforce be declared innocuous because it can be found in homes, court rooms, hospitals, schools, churches and offices. Did the owner" of the instrumentality causing the injury "exercise reasonable care under the circumstances?" That, declared the dissenting justice, "will always be the question."

Common sense clearly indicates that in order to avoid physical injury or injury to valuable clothing and appurtenances, unprotected mechanical equipment subjects its owners to the expense of legal costs and to the possibility of damage payments. Hence, installations of equipment *in any category* so as to reduce foreseeable injury to the vanishing point are advisable.

[Note: While this discussion applies to actual cases, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Maximum Downward Travel of Heated Jets From Standard Long Radius *ASME* Nozzles

By Linn Helander*, Shee-Mang Yen**, and R. E. Crank†, Manhattan, Kan.

This paper is the result of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with the *Industrial Unit Heater Association* and the Engineering Experiment Station of Kansas State College.

SUMMARY — The paper contains graphs and formulas for estimating the maximum downward travel of heated air jets projected vertically downward from long radius *ASME* nozzles of 2 to 17 in. diameter. The tests were conducted for a range of temperatures and velocities. The data presented will have practical guidance value to the air conditioning engineer in determining the limits of air throw for conditions approximating those of the tests.

GRAPHS AND FORMULAS, suitable for estimating the maximum downward travel of perpendicular jets of heated air from long radius *ASME* nozzles and having practical guidance value for air conditioning engineers and designers of unit heaters, are presented in this paper. The graphs, the formulas, and the data upon which they are based are the results of research conducted at Kansas State College under the guidance of the Technical Advisory Committee on Air Distribution††. A previous paper[1] on this research, presented before the Society in 1948, gave data for jets of heated air projected vertically downward from (1) a straight run of pipe 6½ in. in diameter, and (2) a convergent nozzle with an orifice diameter of 5.75 in. Since 1948, studies have been made of heated jets projected vertically downward from long radius *ASME* nozzles with orifices ranging from 2 to 17 in. in diameter. This paper deals with the maximum downward travel, or throw, of these jets. The range of orifice velocities and the range of orifice temperatures employed in the studies are given in Table 1.

Test Procedures and Equipment

Velocities were measured by means of a pitot tube coupled to either a sensitive analytical balance, modified to measure differentials of pressure of the order of 1/5 in. of atmospheric air (equivalent to 0.0002 in. water), or to a micromanometer which could be read to 0.001 in. water. Temperatures were measured by means of shielded thermocouples made of standard thermocouple wire. These were connected to an electronic precision indicator. To locate the bottom of the jet, a pitot tube connected to the modified balance and a thermocouple connected to the indicator were simultaneously moved upward into the jet from a point well below the bottom of the jet. The level of the bottom of the jet was denoted as that level at which the first sustained evidence of velocity was observed, together with a marked change in the temperature gradient and marked fluctuations in temperature. Occasionally, smoke was used as a supplementary means for locating the bottom of the jet.

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[1]Exponent numerals refer to References.

Presented at the 59th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, January 1953.

The thermocouple for measuring the room-air temperature, T_a, was located at the instrument table 30 in. above the floor. Velocities at the orifice recorded as U_o, and temperatures recorded as T_o, were measured at the center of the orifice.

Fig. 1 shows the arrangement of test equipment in the laboratory. Fig. 2 shows dimensions and schematic arrangement of equipment for studying the throw of jets from nozzles having diameters of 6 in. or larger. Air from the blower passes through a heat exchanger to the plenum chamber, and from there to the nozzle. The plenum chamber is 48 in. wide, 50 in. deep, and 54 in. high. It is well insulated. The bottom of the plenum chamber is 34 ft above the level of the floor. The instrument table is shown in Fig. 2 in its approximate location. The nozzles used were spun aluminum nozzles. None of the nozzles except the 4-in. nozzle was insulated. The 4-in. nozzle was covered on the outside with an asbestos insulation about $\frac{1}{8}$ in. thick.

The volume of air delivered to the nozzle was controlled both by varying the speed of the direct current motor and by regulating a remotely controlled damper on the blower inlet. Minor variations in temperature and velocity were observed at the orifice.

All operations were controlled from the floor level. The thermocouple, pitot tube, and smoke gun, when used, were mounted on a motor operated instrument trolley which traveled north and south on an instrument carriage. The carriage in turn was motor operated and traveled east and west on an instrument elevator. The elevator could be moved to any required level by means of a hand-operated winch.

For the jets from the 2-in. and 4-in. nozzles, the test set-up described in the previous paper[1] was employed. In this set-up, the base of the plenum chamber was 23 ft above the floor, and the platform that supported it extended into the free space of the laboratory from upper-level flooring which formed a ceiling on one side of the jet.

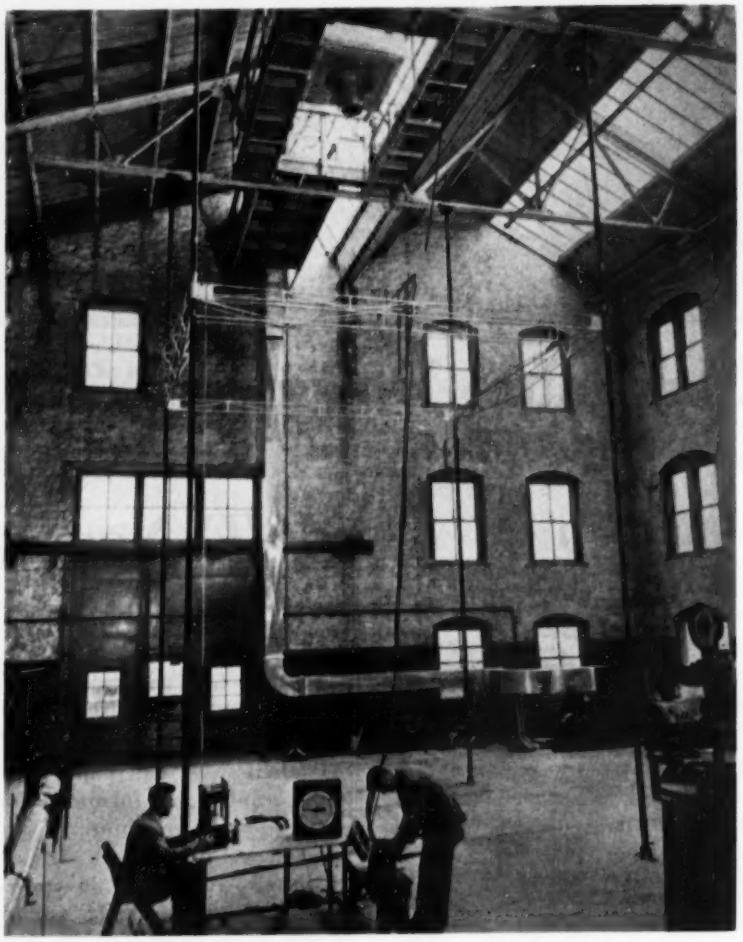


Fig. 1—Arrangement of test equipment in laboratory

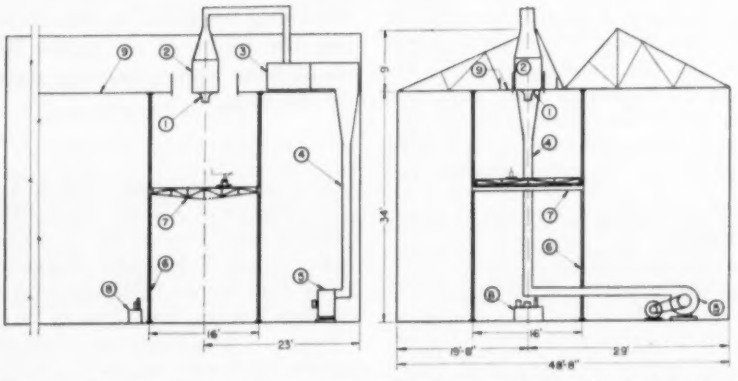


Fig. 2—Dimensions and schematic arrangement of equipment for testing large nozzles

Reference numbers: (1) nozzle, (2) plenum chamber, (3) heat exchanger, (4) duct system, (5) blower, (6) supporting column, (7) instrument elevator, (8) instrument table, (9) catwalk

Table 1—Range of Test Conditions

Size of Nozzle In.	Range of L_{max}/D_o	Range of $(T_o - T_a)$ Deg F	Range of U_o ft/sec
	L_{max}/D_o smaller than 8		
4	1.5 — 6.8	70 — 90	2.5 — 5.5
	L_{max}/D_o between 8 and 45		
2	11 — 45	25 — 60	5 — 19
4	12 — 45	30 — 160	8 — 46
6	14 — 36	110 — 180	14 — 43
8	13 — 38	120 — 190	21 — 55
10	9 — 29	60 — 200	16 — 42
12	12 — 28	30 — 160	16 — 42
14	8 — 22	90 — 160	17 — 32
17	9.5 — 20	80 — 140	19 — 31
	L_{max}/D_o greater than 45		
2	46 — 92	30 — 65	15 — 46

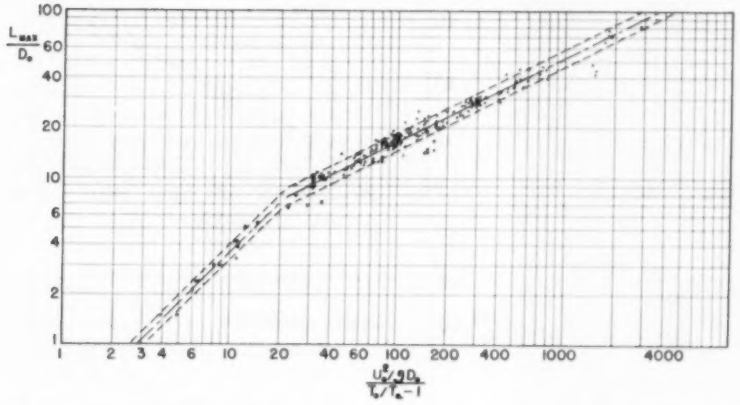


Fig. 3—Throw in orifice diameters L_{max}/D_o, *vs.* buoyancy number, $[(U_o^2/gD_o)/(T_o/T_a - 1)]$

Data on Throw

Fig. 3 is a composite plot of the data on the downward throw of perpendicular jets of heated air obtained since the publication of the previous paper[1]. Figs. 4 to 6 show these data plotted separately for each size of nozzle employed. The data plotted form a band, the boundaries of which lie 10 percent above and 10 percent below the curve of mean values. Within this band lie approximately two-thirds of all the plotted results.

Based on Fig. 3, the following equations for throw are obtained (Symbols are defined in list in Nomenclature):

1. For throws plotted in Fig. 3 equal to or greater than 8 orifice diameters, and for the range of conditions tabulated in Table 1,

$$\frac{L_{max}}{D_o} = 1.66\left(\frac{U_o^2/gD_o}{\frac{T_o}{T_a} - 1}\right)^{\frac{1}{3}}, \pm 10\% \quad \cdots\cdots\cdots (1)$$

2. For throws equal to or less than 8 orifice diameters, and for the range of conditions tabulated in Table 1,

$$\frac{L_{max}}{D_o} = 0.36\left(\frac{U_o^2/gD_o}{\frac{T_o}{T_a} - 1}\right), \pm 10\% \quad \cdots\cdots\cdots (2)$$

Interpretation and Discussion of Results

For throws between approximately 8 and 45 orifice diameters, Equation 1 and the corresponding band in Fig. 3 are supported by a substantial amount and range of test data. For throws in excess of 45 orifice diameters, this equation and band are supported by data on jets from a 2-in. nozzle. On the other hand, Equation 2 and its corresponding band are supported by data obtained from only one series of tests on jets from a 4-in. nozzle. The latter equation and its band therefore should be regarded simply as being indicative of the trend in the magnitudes of throws which are shorter than 8 orifice diameters.

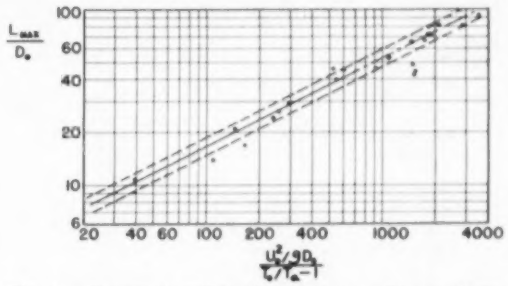


Fig. 4— Throw in orifice diameters, L_{max}/D_o, *vs.* buoyancy number, $[(U_o^2/gD_o)/(T_o/T_a - 1)]$, for jets from 2 in. nozzle

The band drawn in Fig. 3 is a statistically established band within which the throw will probably lie. Figs. 4 to 6 show that the data for each size of jet fall principally within this band. The data for the jet from the 17-in. nozzle, however, lie mainly above the curve of mean values. The bottom of all jets fluctuated appreciably. The throw as plotted, therefore, is a time mean of the instantaneous values of a fluctuating throw.

The following four conditions under which the jets were studied are to be particularly noted:

1. Boundaries of the space into which the jets were projected were remote from the jets, so that the jets may be classified as approximately free jets;

2. Jets were free of whirl at the orifice and of artificially augmented turbulence;

3. The ratio of the cross-stream mean velocity at the orifice to the centerline velocity varied characteristically with the Reynolds number. For the conditions covered by Equation 1, this ratio had an approximate average value of 0.96 and the range of values shown in Table 2. Likewise, for the same conditions, the ratio of the mean elevation of temperature at the orifice to the centerline elevation, and the ratio of the mean buoyancy num-

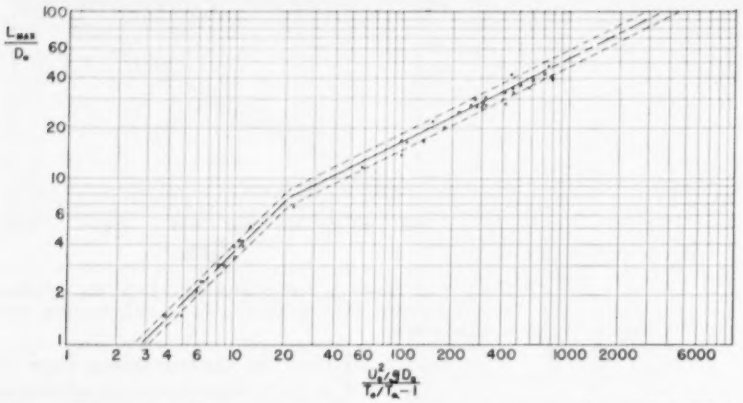


Fig. 5—Throw in orifice diameters, $L_{max.}/D_o$, *vs.* buoyancy number, $\{U_o^2/gD_o)/-(T_o/T_a-1)\}$, for jets from 4-in. nozzle

ber at the orifice to the centerline buoyancy number (quantity in parentheses in Equation 1) each had an average value of 0.96 and the range of values shown in Table 2. Equation 2 is based on low Reynolds numbers at the orifice and corresponding orifice-velocity profiles.

4. Nozzles employed were long radius nozzles suspended from the base of a plenum chamber and free on all sides.[2]

Conditions 1 to 4 must be approximated when Equations 1 and 2 are used to estimate the throw.

Studies are under way to determine the effect that orifice conditions, such as exist at the outlets of commercial types of unit heaters, would have on the throw.

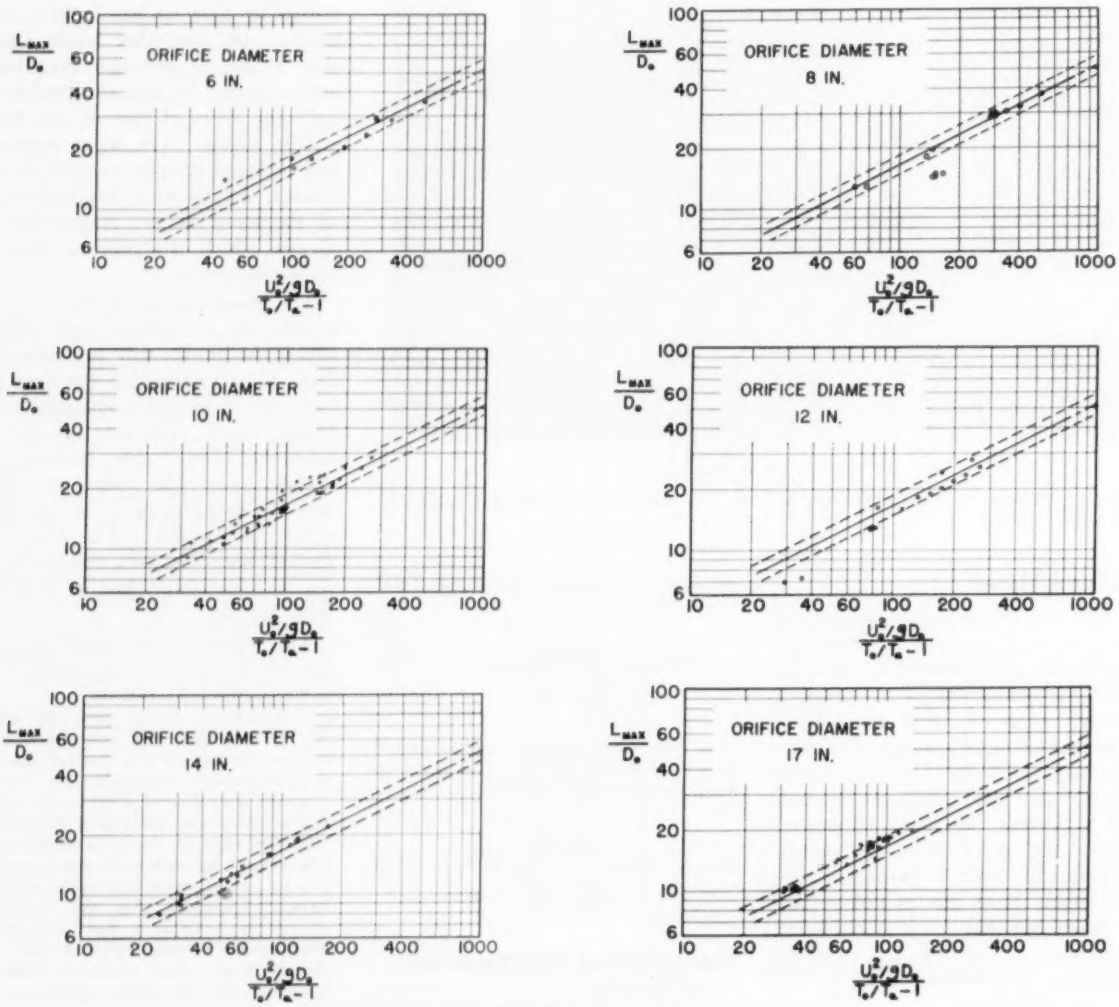


Fig. 6—Throw in orifice diameters, $L_{max.}/D_o$, *vs.* buoyancy number, $\{(U_o^2/gD_o)/(T_o/T_a - 1)\}$, for jets from nozzles with orifices 6 in. to 17 in. in diameter

Table 2—Ratios of Average Velocity, $\overline{U}_o$, Average Elevation of Temperature Above Room Temperature, $\overline{T}_o - T_a$, and Average Buoyancy Number, $\overline{B}_o$, to Corresponding Centerline Values at Orifice.

1	2	3	4	5	6	7	8
Diameter of Orifice In.	Number of Runs	Centerline Velocity U_o Ft per sec	Centerline Buoyancy Number[a] B_o	$(\overline{U}_o/U_o)$ Calculated (Footnote b)	$(\overline{U}_o/U_o)$ Measured	$\frac{\overline{T}_o - T_a}{T_o - T_a}$[c] (Footnote c)	$\frac{B_o/\overline{B}_o}{\text{(Column 5)}}$[c] / (Column 7)
17	2	16 — 22	40 — 71	0.98	0.98 — 0.99	0.99	0.96 — 0.97
10	5	13 — 34	24 — 83	0.97 — 0.98	0.98 — 0.99	0.99	0.95 — 0.96
6	6	21 — 40	129 — 518	0.97 — 0.98	0.98	0.98	0.96 — 0.98
4	5	9 — 28	58 — 1460	0.94 — 0.96	0.97	0.96 — 0.98	0.91 — 0.97
4	7	20 — 30	155 — 361	0.96 — 0.97	0.96	0.90 — 0.91	1.02 — 1.03
2	4	11 — 34	150 — 2390	0.94 — 0.96	0.93 — 0.96	0.96 — 0.98	0.92 — 0.94

[a] $B_o = (U^2_o/gD_o)/(T_o/T_a - 1)$; $\overline{B}_o = (\overline{U}^2_o/gD_o)/(\overline{T}_o/T_a - 1)$.

[b] Evaluated as being the same as the coefficient of discharge calculated from data on page 39 of ASME publication PTC 19.5; 4-1949

[c] Based on area-mean values of temperature at the orifice.
The values 0.90 to 0.91 in column 7 would have been increased probably 2 to 3 percent and the corresponding values in column 8 would have been reduced a like amount had the enthalpy-mean temperature been employed.

Qualitative Description of Jet

Fig. 7 shows the shape of a typical jet which has been made visible by means of smoke. Fig. 8 is a schematic representation of a jet typical of those studied where the throw was greater than approximately 18 orifice diameters. For convenience in dealing with the jet both analytically and descriptively, the jet is represented as having three zones or regions; (1) a primary zone, (2) a principal zone, and (3) a terminal zone.

More data on these three zones are needed before they can be definitively delineated. As represented in Fig. 8, the primary zone extends from the orifice to a level approximately 6 orifice diameters down from the orifice. At this level, a point of inflection occurs in the curve of centerline velocities plotted at the right of the outline of the jet. This point has been taken as marking the nominal end of the primary zone. It has also been taken as the point at which the transition in flow from the pattern at the orifice to the pattern in the principal zone has nominally been completed. The principal zone may, for present purposes, be regarded as being that portion of the jet wherein: (1) Cross-stream temperature profiles may be presumed to form one family of profiles, the cross-stream velocity profiles another; and (2) Degree of consistency among the significant characteristics of the zone, including the curves of centerline velocity and temperature, will be such that one is warranted in assuming that an analytical treatment of the zone will prove fruitful.

Fig. 7—Jet made visible by smoke

The principal zone extends from the end of the primary zone to the point in the jet at which the pattern of flow characteristic of the principal zone begins to decay progressively. The terminal zone extends from this point to the bottom of the jet. The terminal zone, at least the bottom portion of it, is a zone of marked instability.

Typical curves of velocity and temperature along the vertical axis of the jet are shown in Fig. 8 at the

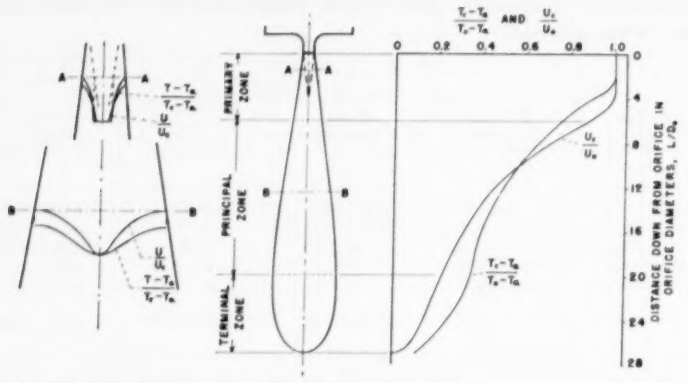


Fig. 8—Schematic representation of a long throw jet
Velocities and temperatures along axis are plotted at right, temperature and velocity profile along diameters are plotted at left

right of the jet; typical velocity and temperature profiles are shown at the left. The temperature profiles are flatter than the velocity profiles; that is, as the jet is traversed along a diameter, the percentage of change in the local jet temperature, measured relative to the established room temperature, is less than the corresponding percentage of change in the downward velocity.

The boundary of the jet is defined as the surface of zero downward velocity. The principal portion of the boundary shown in Fig. 8 was established by observing the travel of thin jets of smoke directed horizontally toward the boundary by a smoke gun. The boundary of the bottom portion of the jet could not be established satisfactorily by this technique. The shape of the bottom of the jet shown in Fig. 8 is, therefore, approximately the shape revealed by pictures of jets made visible by smoke. This shape is also similar to that previously developed from pitot-tube determinations of velocity. (Both the smoke gun and pitot-tube are uncertain means for determining the jet boundary[3]). As was previously pointed out, the bottom of the jet fluctuates about a mean position. The fluctuations occasionally take the form of surges.

The inverted cone that extends downward from the orifice in Fig. 8 is a region of the primary zone which has not been penetrated by the mixing process associated with entrainment. In this region the velocity of the jet deviates little from its orifice value. Another cone might be conceived of as being similarly drawn, but with its apex somewhat closer to the orifice. Such a cone would represent the region in which the jet temperature likewise deviates little from its orifice value.

The jet should be regarded as being projected into an envelope of ambient air which has been set in motion and elevated in temperature by the jet itself. The jet entrains air from this envelope at a temperature above that of the remote room air, measured at a point approximately table height (30 in.) from the floor.

A limited amount of data on the primary zones of short throw jets indicate that the downward penetration of this zone will be significantly reduced as the throw is reduced below a value of approximately 18 orifice diameters. These data also indicate that the temperature and velocity gradients in the vicinity of the orifice may be more pronounced in short throw than in long throw jets. Fig. 8 therefore, should be regarded as typifying long throw jets of the type under consideration, not jets of all types.

Basic Considerations

By dimensional analysis, a dimensionless form of equation is obtainable for the downward throw of perpendicular jets of heated air. Let the assumption be made that the throw will be predictable from the following quantities:

D_o = diameter of the orifice;
$(\rho_o U_o^2)$ = momentum force of the jet at the orifice, per unit of orifice area;
$g\ \rho_o[(\rho_a/\rho_o)-1]$ = buoyancy force per unit volume of orifice air.

Then, by dimensional analysis:

$$\frac{L_{max}}{D_o} = f_1\left(\frac{U_o^2/gD_o}{\frac{\rho_a}{\rho_o}-1}\right)^*$$

Here, f_1 indicates some function, the form of which is to be determined. The quantity $[\rho_a/\rho_o) - 1]$ may be

*The initial grouping of terms assumes that ρ_a and ρ_o will not form a separate dimensionless group. When this assumption is not made, dimensional analysis gives:

$$\frac{L_{max}}{D_o} = f\left\{\left[\frac{U_o^2/gD_o}{(\rho_a/\rho_o-1)}\right], [\rho_a/\rho_o]\right\}$$

For the range of conditions studied and for the particular value of ρ_a employed, the quantity ρ_a/ρ_o was found not to be a significant factor. See discussion of ρ_a/ρ_o under curve fitting procedure in the Appendix.

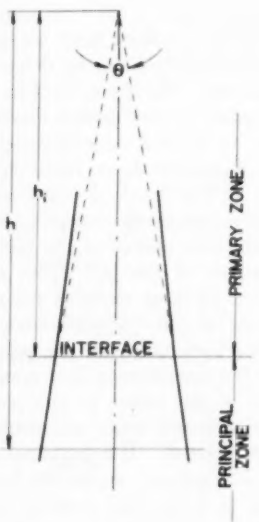


Fig. 9—Tangents to boundary of principal zone at nominal interface between primary zone and principal zone converge on axis and form angle, θ

replaced by $[(T_o/T_a)-1]$ when the jet is a jet of air projected into a buoyant atmosphere with a temperature, T_a, measured at the point at which ρ_a is evaluated.

The dimensionless quantity

$$\left(\frac{U_o^2/gD_o}{\frac{\rho_a}{\rho_o}-1}\right)$$

and quantities similarly formed, will be referred to as buoyancy numbers and designated by the symbol B with appropriate subscripts. Thus B_o will be evaluated at the orifice, and will have the value

$$\left(\frac{U_o^2/gD_o}{\frac{\rho_a}{\rho_o}-1}\right)$$

or its equivalent

$$\left(\frac{U_o^2/gD_o}{\frac{T_o}{T_a}-1}\right)$$

Using this symbolization, Fig. 3 indicates that:

1. For throws plotted in Fig. 3 equal to or greater than 8 orifice diameters, and for the range of conditions tabulated in Table 1,
$L_{max}/D_o = 1.66(B_o)^{\frac{1}{2}}$, $\pm$ 10%.
2. For throws less than 8 orifice diameters, and for the range of conditions tabulated in Table 1,
$L_{max}/D_o = 0.36\ B_o$, $\pm$ 10%.

The nominal interface between the primary zone and the principal zone may, like the orifice, be treated as a section of the jet at which a buoyancy number may be evaluated and used to predict the subsequent travel of the jet. When the interface is so treated, and certain assumptions are made in addition to the kind previously employed, the following form of equation, developed in the Appendix, is obtainable:

$$\frac{\Delta L_{max}}{D_i} = \frac{C}{a}\left([ab_1B_{ic}+1]^{\frac{1}{2}}-1\right) \quad \cdots\cdots (3)$$

where

B_{ic} = the buoyancy number evaluated at the center of the interface between the primary and principal zones.

a = an apex angle and entrainment rate factor, and has the value 2 tan $\theta/2$,

Nomenclature

a = a dimensionless entrainment factor equal to 2 tan $(\theta/2)$. See Fig. 9.

B_o = buoyancy number at orifice,

$$\frac{U_o^2/gD_o}{(T_o/T_a)-1}$$

$\bar{B}_o$ = Cross-stream average buoyancy number at orifice.

B_{ic} = buoyancy number at center of nominal interface between primary and principal zones,

$$\frac{U_{ic}^2/gD_i}{(T_{ic}/T_a)-1}$$

b_1 and b_2 = Dimensionless quantities to be determined experimentally.

C = A symbol in Equations 3 and 5 for dimensionless quantities to be determined experimentally.

C = A symbol used as subscript to indicate values at the vertical axis of the jet.

D_o = diameter of the jet at the orifice, feet.

D_i = diameter of the jet at the nominal interface between the primary zone and the principal zone, feet.

f = A symbol meaning *function of*. With a subscript, f denotes a specific form of function to be determined.

g = Acceleration of gravity, feet per (second) (second).

h_i = Distance from apex of principal zone, extended as in Fig. 9, to nominal interface between primary zone and principal zone, feet.

h_{max} = Distance from apex of principal zone, extended as in Fig. 9, to bottom of jet, feet.

i = subscript denoting value at nominal interface between primary zone and principal zone.

L_i = Distance from orifice to nominal interface between primary zone and principal zone, feet.

ΔL_{max} = distance from nominal interface between primary and principal zones to bottom of jet, feet.

L_{max} = distance from orifice to bottom of jet, feet.

o = subscript denoting value at orifice.

T_{ic} = temperature of jet at center of interface between primary zone and principal zone, Fahrenheit, absolute.

T_o = temperature of air at orifice, measured at center of orifice, Fahrenheit, absolute.

$\bar{T}_o$ = Cross-stream average temperature at orifice, Fahrenheit, absolute.

T_a = temperature of undisturbed room air, measured at instrument table approximately 30 in. above floor, Fahrenheit, absolute.

U_o = Velocity of air at orifice, measured at center of orifice, feet per second.

$\bar{U}_o$ = Cross-stream average velocity at orifice, feet per second.

U_{ic} = Local velocity of jet at center of interface between primary and principal zones, feet per second.

θ = Apex angle formed by tangents to boundary of principal zone at interface between primary zone and principal zone. See Fig. 9.

ρ_a = Density of room air at point T_a is measured, slugs per cubic foot.

ρ_{ic} = Density of jet air at center of interface between primary zone and principal zone, slugs per cubic foot.

ρ_o = Density of orifice air corresponding to temperature T_o, slugs per cubic foot.

Note: Nominal interface between primary zone and principal zone = Plane at which primary zone nominally ends and principal zone nominally begins. See Figs. 8 and 9.

where θ is the apex angle of the principal zone as shown in Fig. 9.

For very low values of throw, one may assume that the principal zone begins at the orifice and that a approaches zero. Then, for this case:

$$\triangle L_{max} = L_{max}$$
$$D_i = D_o$$
$$B_{ic} = B_o$$

and,

$$\frac{L_{max}}{D_o} = (Cb_i/2)B_o = b_2 B_o \quad \cdots\cdots (4)$$

For long-throw jets, a straight line relation between $\frac{D_i B_{ic}}{D_o}$ and B_o will be assumed. When this is done, and substitutions are made in Equation 3 that are in accord with the geometry of Fig. 9, the following form of equation, which is developed as Equation 7A in the Appendix, is obtainable for use in matching experimental data:

$$\frac{L_{max}}{D_o} = \left[C_1 B_o + C_2\right]^{\frac{1}{2}} + C_3 \quad \cdots\cdots (5)$$

Equations 1 and 2, given earlier in this paper, have the form:

$L_{max}/D_o = b_2 B_o$, for Equation 2, and $L_{max}/D_o = [C_1 B_o]^{\frac{1}{2}}$, for Equation 1, (obtained by setting C_2 and C_3 each to zero).

The coefficients b_2 and C_1 were established by the method of least squares. Equations 1 and 2 plot as straight lines on log-log paper, with a slope of unity in the region of short throws and a slope of ½ in the region of long throws. For straight-line equations with these slopes on log-log paper, Equations 1 and 2 constitute the best match of experimental data.

The applicable range of values of C_1, C_2, and C_3 was explored in establishing the most advantageous modification of Equation 5.

Comparisons with Data in Previous Paper

The present paper uses the subscript o, in place of subscript 1, to denote conditions at the orifice and introduces a new symbol, B, to denote the buoyancy number. Except for these changes, the notation used in the present paper is the same as the corresponding notation used in the previous paper.[1]

Equation 1 for throw as given in the previous paper has the following form in the notation of the present paper:

$$\frac{L_{max}}{D_o} = \frac{1}{a}\left(\left[aB_o + 1\right]^{\frac{1}{2}} - 1\right) \quad \cdots\cdots (6)$$

Equation 1 of the previous paper was derived on the basis of assumptions which were equivalent to placing the beginning of the principal zone at the orifice. When the principal zone is so placed, Equation 3 of the present paper leads directly to Equation 6 and therefore to Equation 1 of the previous paper. Thus for this case L_{max} will replace $\triangle L_{max}$ in Equation 3, D_o will replace D_i, B_o will replace B_{ic}, and b_i and C will each be unity. Fig. 10 shows a comparison of Equation 1 of the previous paper with Equations 1 and 2 of the present paper. For this comparison, the factor a has been given the value previously assigned to it, namely, 0.334.

Fig. 10 of the previous paper presents data on the upper and lower limits of the varying travel of a jet from a 5.75-in. converging nozzle. If these data were replotted on Fig. 3 of the present paper, they would form a curve of mean values that would lie parallel to but 10 percent below the mean curve established in Fig. 3 for throws in excess of 8 orifice diameters. Two considerations are involved here. First, the 5.75-in. convergent nozzle was not a long-radius *ASME* nozzle, although it had somewhat the shape of that type of nozzle. Second, means for determining the bottom of the jet employed previous to 1948 were probably somewhat less sensitive than those employed since that date. However, aside from these considerations, the discrepancy between the mean values of the two sets of data is not significant. The mean of the upper and lower limits of travel of a jet is not necessarily the same as the measured mean throw, and, in any event, the data plotted in Fig. 3 show a normal spread of ± 10 percent.

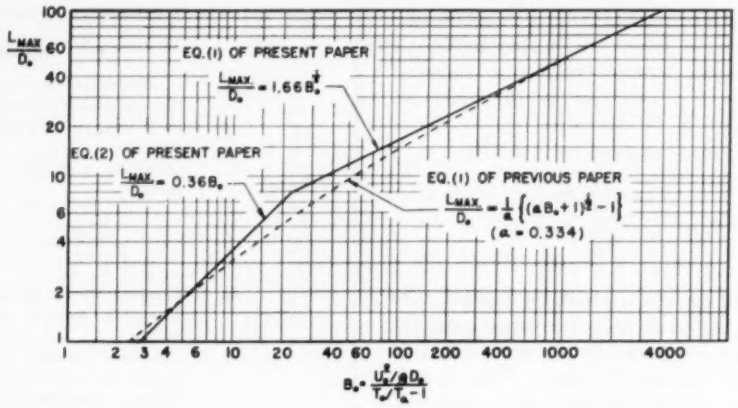


Fig. 10—Comparison of present and previous equations for evaluating throw.

Conclusions

Figs. 3 to 6 are the basic contributions of this paper to information on the downward throw of perpendicular jets of heated air. For the type of jets with which the paper deals, and for the range of conditions tabulated in Table 1, these figures show:

1. That B_o, the buoyancy number

$$\frac{U_o^2/gD_o}{(T_o - T_a)/T_a}$$

is an adequate parameter for correlating the data presented on the downward throw of perpendicular jets of heated air (For a discussion of T_o/T_a as an independent parameter, refer to Curve Fitting Procedure in Appendix);

2. That these data plotted against this buoyancy number on log-log paper form a

band of most probable values;

3. That this band is satisfactorily represented by two equations:

(*a*) For throws between 8 and 90 orifice diameters,

$L_{max}/D_o = 1.66\ B_o^{\frac{1}{3}}$, ± 10 percent.

(*b*) For throws less than 8 orifice diameters,

$L_{max}/D_o = 0.36\ B_o$, ± 10 percent.

The second of the foregoing equations (*b*) is supported only by a limited amount of data obtained on jets from a 4-in. nozzle. It should therefore be regarded simply as indicative of values of throw shorter than 8 orifice diameters. For throws between 8 and 45 orifice diameters, the first equation (*a*) is supported by a substantial amount of data on jets from nozzles having orifices 2 to 17 in. in diameter. For throws in excess of 45 orifice diameters, this equation is supported by data on jets from a 2-in. nozzle. Conservative use of the first equation (*a*) for throws in excess of 45 orifice diameters appears justified.

At least one additional study using a nozzle larger than 2 in. in diameter should be made to verify the data on throws in excess of 45 orifice diameters. Many more data are needed on throws below 8 orifice diameters. A standardized procedure for locating the bottom of a downwardly projected jet of heated air is needed, and should be developed. Until such a procedure is developed, results obtained in the field and in the laboratory may not be comparable. The procedure should, so far as practicable, make use of recording instruments to locate the bottom of the jet. The feasibility of making use of such instruments, therefore, is a matter that should be investigated promptly.

An investigation of the throw of jets cannot be divorced completely from a study of other aspects of jet behavior. The data presented in this paper therefore will be under continuous review as research on other aspects of the jet progresses. Except for this, and the additional data to be obtained for very short and very long throws, this paper fulfills one objective of the research program; that of providing data for predicting the downward throw of heated jets from standard long-radius *ASME* nozzles under the conditions investigated.

Acknowledgments

The data presented in this paper are the result of observations made by many who previously were on the staff of the Department of Mechanical Engineering at Kansas State College as research assistants or instructors. Among these, Huo-Psi Pan, P.S. Wood, and E. H. Copeland made noteworthy contributions. The statistical analyses were made by Dr. H. C. Fryer of the Department of Mathematics, Kansas State College.

The guidance of the members of the Technical Advisory Committee on Air Distribution, and particularly the encouragement offered by Ernest Szekely, Howard Brinen and Dean M. A. Durland were exceedingly helpful.

References

1. Downward Projection of Heated Air, by Linn Helander and C. V. Jakowatz (ASHVE TRANSACTIONS, Vol. 54, 1948, p. 71).

2. The Effects of Boundary Conditions on the Primary Zone of a Downward Projected Jet of Heated Air, by G. E. Moeller (Master's Report, Kansas State College).

3. A Smoke-Filament Technique for Experimental Research in Room Air Distribution, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, Vol. 24, July 1952, p. 123).

APPENDIX

Development of Form of Equation for the Downward Throw

Referring to Fig. 9, let the point of convergence of the sides of the principal zone extended tangentially be regarded as the origin of a coordinate system. Assume that h_{max} is a function of:

1. A characteristic momentum force per unit area, $\rho_{ic} U_{ic}^2$;
2. A characteristic buoyancy force per unit volume,

$$g\rho_{ic}\left[\left(\frac{\rho_a}{\rho_{ic}}\right)-1\right];$$

3. A characteristic length, h_i, and
4. A dimensionless (velocity-profile)-(temperature-profile) shape factor, b_i.

Then dimensional analysis gives:

$$\frac{h_{max}}{h_i} = f_1\left\{b_i U_{ic}^2/gh_i\right]\Big/\left[\left(\frac{\rho_a}{\rho_{ic}}\right)-1\right]\right\} \cdots\cdots (1\text{-}a)$$

Substituting $(\Delta L_{max} + h_i)$ for h_{max}, (D_i/a) for h_i, and solving for $(\Delta L_{max}/D_i)$:

$$\frac{\Delta L_{max}}{D_i} = \frac{1}{a}\left[f_1(ab_iB_{ic})-1\right] \cdots\cdots (2\text{-}a)$$

where

$$B_{ic} = \left[U_{ic}^2/gD_i\right]\Big/\left[\frac{\rho_a}{\rho_{ic}}-1\right].$$

Apply Equation 2*a* to the case of a body falling with negligible friction* and entrainment in a buoyant fluid and having an initial velocity U_{ic}. For this case *a* will approximate zero and ΔL_{max} will approximate

$$b_i U_{ic}^2/2g\left[\frac{\rho_a}{\rho_{ic}}-1\right];$$

Substituting this value for ΔL_{max} in Equation 2*a* and transposing,

$$f_1[ab_iB_{ic}] = \tfrac{1}{2}ab_iB_{ic}+1, \text{ for} \cdots\cdots (3\text{-}a)$$

the case wherein *a* approaches zero.

Experimental evidence shows that Equation 3*a* is not valid when $(a\ b_iB_{ic})$ is large relative to unity. We must seek, therefore, a form of equation that resolves into Equation 3*a* when $(a\ b_iB_{ic})$ approximates zero, but is not identical with Equation 3*a*. One such equation is:

$$f_1[ab_iB_{ic}] = \left[ab_iB_{ic}+1\right]^{\frac{1}{2}} \cdots\cdots (4\text{-}a)$$

*In the absence of friction the body will fall until the work done against the buoyancy force equals the initial kinetic energy of the body. Thus:

Travel × Buoyancy force = Initial kinetic energy

$(\Delta L_{max}) \times g\left[(\rho_a/\rho_{ic}) - 1\right] = b_i U_{ic}^2/2$, where b_i for this case is unity.

Combining Equations 2*a* and 4*a*, and introducing an experimental factor, C;

$$\frac{\Delta L_{max}}{D_i} = \frac{C}{a}\left\{\left[ab_i B_{ic}+1\right]^{\frac{1}{b}}-1\right\} \quad \text{(5-a)}$$

Multiply both sides of Equation 5*a* by D_i/D_o, replace L_{max} by $(L_{max} - L_i)$, and solve for (L_{max}/D_o). Then:

$$\frac{L_{max}}{D_o} = \frac{C}{a}\left\{\left[a\left(b_i\frac{D_i}{D_o}\right)\left(\frac{D_i}{D_o}B_{ic}\right)+\left(\frac{D_i}{D_o}\right)^c\right]^{\frac{1}{b}}-\left(\frac{D_i}{D_o}\right)\right\}+\frac{L_i}{D_o} \quad \text{(6-a)}$$

As an approximation,

Let $(D_i/D_o)B_{ic} = nB_o + m$, and consolidate quantities other that B_o into the form of factors to be experimentally determined. Then:

$$\frac{L_{max}}{D_o} = \left[C_1 B_o + C_2\right]^{\frac{1}{b}} + C_3 \quad \text{(7-a)}$$

Curve Fitting Procedure

Various modifications of Equation 7*a* were tried out for throws in excess of approximately 8 orifice diameters. None gave a significantly better match of experimental data than a straight-line equation on log-log paper. When no restrictions were placed on slopes, the method of least squares gave as the exponents of B_o:

For long throw jets — 0.49 instead of 0.50.

For short throw jets — 1.02 instead of 1.00.

To determine whether or not T_o/T_a, or ρ_a/ρ_o, should be included as a separate parameter in the equation for throw, the following procedure was employed:

Plotted values of L_{max}/D_o were organized to form groups within each of which the buoyancy number, B_o, had an approximately common value. The values of L_{max}/D_o in each group were then adjusted to a common value of B_o for the group, and these compensated values were plotted against $(T_o - T_a)/T_a$. The result, for each group, was a random scattering of points about a horizontal line. The quantity,

$$\frac{L_{max}}{D_o\sqrt{B_o}}$$

was also plotted against each of the quantities $[(T_o/T_a)-1]$, T_a, and T_o. The result in each case was again a random scattering of points about a horizontal line. These results indicate that for the range of conditions employed and for the location at which T_a was measured, neither T_o/T_a nor T_o is a significant independent parameter. Since the room temperature varies from floor to ceiling, T_o/T_a should be regarded as a probable independent parameter unless experimental evidence proves it to be otherwise. For air, T_o/T_a may be set equal to ρ_a/ρ_o. Therefore, when T_o/T_a is not a significant independent factor, ρ_a/ρ_o likewise will not be a significant independent factor.

N. Y. COMPLETES AIR POLLUTION CONTROL BOARD

Mayor Vincent Impellitteri of New York City recently announced the appointment to the Board of Air Pollution Control two members of ASHVE, thus completing the personnel of this group. Appointed for a four-year term was Prof. Carl F. Kayan, executive officer of the Department of Mechanical Engineering, Columbia University; and appointed for two years was Richard A. Wolff, secretary of Wolff & Munier, Inc., a consulting engineering firm in New York.

The Board of Air Pollution Control will adopt and amend the rules regulating or prohibiting the emission of air pollutants, will hold hearings and will fix fees for the issuing of permits and the examination of plans.

Professor Kayan and Mr. Wolff, who were sworn in on February 13, were recommended for their appointments by Dr. Leonard Greenburg, New York Commissioner of Air Pollution Control and a member of the Society since 1932. Professor Kayan joined the Society in 1942 and Mr. Wolff has been a member since 1945.

In addition to the two new appointees, ex-officio members of the control board are: Dr. Greenburg, Bernard J. Gillroy, Commissioner of Houses and Buildings, and Dr. John F. Mahoney, Commissioner of Health.

1953 LEHIGH CONFERENCE ON YEAR-ROUND RESIDENTIAL AIR CONDITIONING PLANNED

Under the direction of J. V. D. Eppes, associate professor of mechanical engineering at Lehigh University, Bethlehem, Pa., a Conference on Year-Round Residential Air Conditioning is being planned. The University hopes that representatives of builders, equipment manufacturers, and research groups will be able to explore the areas in which research and development are needed in this field.

Several organizations, in addition to ASHVE, have been asked to assist in forming a committee which will prepare suitable technical topics, secure speakers and discuss details for a regional conference which will be held at Lehigh University on April 24-25, 1953. Among the organizations asked to participate are: the *American Society of Mechanical Engineers; American Society of Refrigerating Engineers; Air Conditioning and Refrigerating Machinery Association; National Association of Home Builders; Building Research Advisory Board* and the *National Warm Air Heating and Air Conditioning Association.*

Pres. Reg F. Taylor of ASHVE has appointed W. A. Grant, director of research, Carrier Corp., Syracuse, N.Y., to serve as the Society's representative on this committee.

Rocky Mountain Chapter Plans 1953 Semi-Annual Meeting

DENVER, mile high city, capital of Colorado and the Rocky Mountain Empire, will be the site of the Semi-Annual Meeting 1953 of ASHVE. At the hub of a network of seven railroads, five airlines and six major highways, with the snow-capped Rockies providing a magnificent background, the Rocky Mountain Chapter is looking forward to welcoming the Society on June 29, 30 and July 1, 1953.

The Program and Papers Committee, headed by Prof. B. H. Spurlock, Jr., has planned a program of three technical sessions which will include several research papers. There will be activities for the ladies, a golf tournament for men and other diversions.

In addition, the justly famed scenic wonders of the Rockies are but a few miles from Denver with their many attractions. Among these sights are Estes Park and the Rocky Mountain National Park, famed for mountain grandeur; Colorado Springs, only 70 miles from Denver with Pikes Peak, Garden of the Gods, Seven Falls and the Cave of the Winds.

Aerial view of Denver's Civic Center. Colorado State Capital on the right. Denver City and County Building on the left. The United States Mint is immediately right of the City Building

City Park, Denver's largest, covering one square mile. The pavillion for band concerts is located in this park together with the Denver Museum of Natural History

Not far from Denver are found some of the historic old mining towns which preserve much of the flavor of the Old West. Central City is one of the towns where many of the gold mines are still being worked, and the Central City Opera House presents the Annual Opera Festival during July with Metropolitan Opera Stars.

For the sports minded fishing in the mountain streams, and hunting in the forest preserves abound within a few miles of Denver. For the automobile traveler, Denver and the nearby parts of Colorado offer an abundance of scenic drives and rugged wilderness — in short a wonderful vacationland.

The Committee on Arrangements, under the able direction of Fred Janssen as general chairman and Professor Spurlock as honorary chairman, and the entire Rocky Mountain Chapter anticipate welcoming the Society members in Denver for the ASHVE Semi-Annual Meeting, 1953.

Ernest Szekely, Milwaukee, Wis.
President

59th Annual

The 59th Annual Meeting of the ASHVE held in Chicago, Ill., at the Conrad Hilton Hotel, was the largest ever with a total registration of 2814. This included 1620 members, 831 guests, and 363 ladies. A total of 1853 valid ballots were cast for the several offices to be filled. Those elected are: *President*—Reg F. Taylor, Houston, Tex.; *First Vice President*—L. N. Hunter, Johnstown, Pa.; *Second Vice President*—J. E. Haines, Minneapolis, Minn.; *Treasurer*—J. W. James, Chicago, Ill.

The four new Council members elected for a three-year term are: I. W. Cotton, Indianapolis, Ind.; A. W. Edwards, Cincinnati, Ohio; L. T. Mart, Kansas City, Mo., and E. R. Queer, State College, Pa. Bruce L. Evans, St. Louis, Mo., was elected to a one-year term on the Council.

The five new members of the Committee on Research who will serve three-year terms are: R. S. Dill, Washington, D.C.; F. H. Faust, Bloomfield, N. J.; R. W. Keeton, M. D., Chicago, Ill.; H. A. Lockhart, Morton Grove, Ill.; and J. W. McElgin, Philadelphia, Pa. A. J. Hess, Los Angeles, Calif. was appointed to fill a one-year vacancy on the Committee.

There were six technical sessions presenting a total of fifteen papers on a wide variety of subjects; one session was a research administration symposium with three speakers.

In addition to the Council and Committee on Research meetings, there were meetings of nearly all the Council Committees, the Guide Committee, the Committee on Revision of Code of Minimum Requirements for Comfort Air Conditioning, the Heavy Duty Furnace Committee and the Chapters Conference Committee. Many Technical Advisory Committees met, including Insulation, Air Cleaning, Heat Pump, Industrial Environment, Panel Heating and Cooling, Air Distribution, Heat Flow Through Glass, Hot Water and Steam Heating, Combustion, Cooling Load, Sound and Vibration Control, Heating Load and Sorption.

The Committee on Arrangements of the Illinois Chapter had planned a full round of activities for the members and their wives. On Monday and Wednesday afternoons a Luncheon and Miniature Grand Opera program was pre-

FIRST SESSION, MONDAY, JANUARY 26, 9:30 A.M.

The 59th Annual Meeting, was called to order in the Grand Ballroom of the Conrad Hilton Hotel, Chicago, by First Vice Pres. Reg F. Taylor owing to the illness of Pres. Ernest Szekely.

Announcement was made that any member wishing to withdraw a proxy or change his vote could do so by giving notice to the proxies, C. M. Burnam, Jr., C. H. Flink, or B. M. Kluge, before 11:30 A.M., at which time the ballot box would be closed.

A. V. Hutchinson, Executive Secretary, presented the Report of the Council.

Report of Council

As required by Section 46 of the Membership Corporations' Law of the State of New York the following report is presented by the Council and filed herewith:

Assets

The Society has the following Assets:

Land and Laboratory Buildings at Cleveland, Ohio	$ 81,012.89
Furniture and Equipment, Tools, etc. at New York and Cleveland	42,106.80
On Deposit in New York and Cleveland banks	118,929.31
Securities (United States and Canadian Government Bonds) with Bankers Trust Company, New York as custodian	105,070.63
Accounts Receivable	14,191.27
Inventory Items	12,669.27
Deferred Items	8,028.84
Miscellaneous	2,911.40
Totals	$384,920.41
1951 Total	395,803.37
Decrease	$ 10,882.96

The sources of Society Cash Receipts were:

Admission Fees and Dues	$122,425.80
Publications	156,772.67
Interest	1,665.42
From Research	175,593.51
Miscellaneous	442.50
Total	$456,899.90

Meeting

sented for the ladies at the Kungsholm Restaurant, and on both days was well attended by 215 ladies on Monday and 177 on Wednesday. As an alternative to the Luncheon and Opera, the Ladies Committee sponsored a Tea and Drama program at the Conrad Hilton Hotel, attended by 157 ladies on Monday and 182 on Wednesday afternoon.

The Officers, Council and Illinois Chapter Officers attended a luncheon at the Saddle and Sirloin Club on Monday prior to the official opening of the Exposition at 2:00 P. M. Following the luncheon the group adjourned to the International Amphitheatre and formally opened the 11th International Heating, Ventilating and Air Conditioning Exposition.

On Monday night, the Annual Get-Together, held in the Grand Ballroom of the Conrad Hilton Hotel, featured an excellent orchestra together with entertainment highlighted by a group of five male singers.

On Tuesday afternoon a Tea and Style Show at the Narcissus Room of Marshall Field & Co. attracted 369 wives of the members to a showing of spring and summer fashions.

Wednesday night the 59th Annual Banquet was held in the Grand Ballroom of the Conrad Hilton Hotel attended by 1100 members, their wives and guests. With nearly every state in the Union, and several foreign countries represented, it was a fitting climax to a successful meeting. Pres. Ernest Szekely, Milwaukee, Wis., in a short address presented the F. Paul Anderson Medal and Award Citation to E. N. McDonnell, Chicago, Ill., in recognition of the latter's *outstanding work in the field of heating, ventilating and air conditioning.* Past President L. E. Seeley, Durham, N. H., presented the Past President's Medal to outgoing Pres. Ernest Szekely. The speaker of the evening was Nathaniel Leverone, whose talk, *This Freedom Of Ours*, presented an outline of those characteristics and principles that have helped to build our country. Dancing followed the banquet and was enjoyed by many.

Inspection trips of several local firms rounded out the program of events of the Society's 59th Annual Meeting.

Reg F. Taylor, Houston, Tex.
President-Elect

Cash Disbursements were:

Meetings, Committees and Chapters	$ 26,142.20
Publications	125,606.93
Headquarters	116,693.29
Fund Raising	13,734.89
Research	169,050.24
Total	$451,227.55

The Society's Reserve Fund was increased by the addition of $7,243.00 Admission Fees and $1,995.49 Interest earned on Savings, Bank Accounts and Securities. This is an increase of $9,238.49, bringing the Reserve Fund to $84,442.89.

Now in the Custodian Account of the Bankers Trust Co., New York, there are securities of the United States and Canadian Governments and a utility which cost: General Fund $35,790.61, Reserve Fund $53,631.50, and F. Paul Anderson Fund $1,000.00. The Research Reserve Fund now stands at $10,338.30.

Liabilities

The Society has the following Liabilities:

Reserve for building maintenance	$ 2,000.00
Accounts Payable	—0—
Federal Withholding Taxes	1,275.85
Accrued Accounts	11,440.13
Deferred Income:	
Research Projects	6,274.39
Prepaid Dues, Initiation Fees, etc.	4,597.96
Reserve for TRANSACTIONS	15,341.91
Net Worth (Funds)	343,990.17
Total	$384,920.41

At the end of the fiscal year, October 31, 1952, the Balance Sheet shows the Society's Net Worth as $343,990.17 compared to $358,041.65 on October 31, 1951, a net loss of $14,051.48.

The Property Fund covering the Laboratory Land and Buildings at Cleveland, Laboratory Equipment and Tools, Furniture and Fixtures at Headquarters, New York and Cleveland is $123,119.69.

Fire insurance of $200,000.00 is carried on buildings, $137,500.00 on contents, sprinkler $12,000.00, also Comprehensive Bodily Injury $100,000-$300,000.00 and Auto Property Damage $5,000.00, Medical, $1,000.00. Fidelity Bonds on Officers and all employees $20,000.00. Workmen's Compensation is carried in New York and Ohio, as required by law.

The Society has contributed to the Employees Retirement Plan Trust $2,313.80 and the participating employees contributed a similar amount deducted from salary.

Total cash in New York and Cleveland banks $118,929.31, consisting of $61,623.73

ASHVE Officers, Council, Illinois Chapter Officers and Exposition management lunch at Saddle & Sirloin Club *(l to r) Seated:* J. E. Haines, A. W. Edwards, R. T. Kern, B. L. Evans, B. H. Spurlock, Jr., G. G. Freyder, J. D. Kroeker, G. B. Supple, P. B. Gordon, J. H. Fox, J. W. James, G. V. Zintel, I. W. Cotton, L. T. Mart, N. H. Peterson, E. R. Queer, L. N. Hunter. *Standing:* M. K. Fahnestock, E. K. Stevens, Reg F. Taylor, C. F. Roth, and D. M. Mills.

in General Operating Fund, $19,841.12 in Reserve Fund, $195.91 in F. Paul Anderson Fund, $25,689.62 in the Research Fund, $10,338.30 in Research Reserve, $704.10 in Research Endowment, and $536.82 in the Building Fund.

MEMBERSHIP

The Society admitted the following members in the grades indicated since January 1, 1952:

Members	283
Associates	10
Affiliates	316
Junior Members	339
Students	130
Total	1078

The names and addresses of the candidates for membership were published in the JOURNAL of the Society each month during the year and are on record in the Secretary's office. The present membership total is 8468.

Respectfully submitted,
Ernest Szekely, *President*
J. Donald Kroeker, *Treasurer*

Treasurer's Report

Treas. J. Donald Kroeker presented the Treasurer's Report, including the audit of the Society's accounts by Frank G. Tusa and Co., Certified Public Accountants, for the fiscal year ending October 31, 1952.

In conformity with the By-Laws, the audit of the Society's accounts is presented herewith in the form of a *Report of Examination* for the fiscal year ending October 31, 1952, prepared by Frank G. Tusa & Co., Certified Public Accountants.

Viewing the operation of the Society for the fiscal year reported, certain factors may be of interest. On an accrual basis, expenses are shown exceeding income by $25,863.27. On a cash basis, receipts exceeded disbursements by $5,672.35. The Council was faced this year with several natural conditions.

a. While dues levels were fixed, it was necessary to increase staff for service to a membership which has nearly trebled in the last ten years.

b. Research income was below normal. The year was the first in six years without the substantial research income from the International Exposition Co. in its operation of the heating and ventilating expositions. Further, research income was affected by implementation of a new type of program for fund raising, requiring time and experience for full effectiveness.

So the year was in a measure one of adjustment, in which the Council found that, to conduct the Society's fiscal program wisely, it was necessary to dip into reserves provided for the purpose.

And yet the Society's financial structure remains in excellent condition, as figures on net worth will show. The growth of net worth during the last 22 years, Fig. 1, shows that the net worth has increased from $23.50 per member 20 years ago to $40.00 this year, more than two and a half times the amount of unearmarked dues per member.

Probably a more concise and comprehensive conception can be had of the Society's financial operation from Fig. 2, *Comparison of Income and Expense*, than from study of the detailed figures in the accountant's report. Particularly significant is a consistent approximate balance of dues income and expense for administration, meetings, committees, and chapters. Thus, most of the substantial net income from publications remains available for research in fulfilling one of the Society's prime purposes, the investigative and educational functions toward the public welfare.

For every dollar of unearmarked dues and admission fees the Society had an income of $3.76.

Several actions of the Council during the fiscal year are significant:

a. A building fund of some $35,000 was created by setting aside certain securities for availability in the event it becomes feasible to erect quarters for the headquarters operation.

b. An Investment Advisory Committee has been created. This committee, composed of prominent business men of the Society, serving for extended terms, will advise the Finance Committee on investments in a continuity toward a planned investment program.

c. Accounting has been changed to an accrual basis better to reflect fiscal status.

During the year the Finance Committee developed a study of the effect of increased membership, which has pointed toward desirability, if not necessity, of an active membership encouragement program, if dues are held at current levels. The last such program was pursued in 1949. A net increase of 1000 members per year is considered attainable with parallel improvement in quality.

The Society's structure for conducting the basic and fundamental research, to which it is dedicated and the backlog of which is tremendous, is suitable to pursue an annual program extending toward a million dollars. The chief limitation is the funds available.

Here is a point at which self evaluation toward more general participation is indi-

Second Vice Pres. L. N. Hunter (*left*) and First Vice Pres. Reg F. Taylor enjoy words of welcome from M. W. Bishop (*standing*) at opening session

Mr. and Mrs. P. J. Marschall, together with C. Rollins Gardner (*right*)

cated. It is conservatively estimated that more than $20,000,000 is expended annually in research, including that toward product development, in the field of heating, ventilating and air conditioning. Of this amount, less than one percent is expended exclusively toward basic and fundamental research by the Society dedicated to this activity.

No one can question the very material progress in the art of heating, ventilating, and air conditioning which has resulted from the Society's research. Evidence and proof are at every hand. It is therefore the base upon which each of our businesses and professions rests. And yet there are relatively very few companies and virtually no professional offices which contribute financially toward research to strengthen and enlarge this base.

It would seem logical and certainly painless for each business and professional office to contribute *regularly* to the research program according to its own formula, perhaps based on a fractional percentage of its net income. I suggest this to you for your serious consideration.

If this is done, the list of contributors could easily swell from about 125 to 3000 within a few years, the research base upon which our works rests would be firmed and broadened, and we would see the art advance toward greater benefits to ourselves and the public.

In conclusion, it is obvious your Society is in good financial condition; has seen remarkable growth, and should be expected to have a greater and more beneficial future.

Respectfully submitted,
J. Donald Kroeker, *Treasurer*

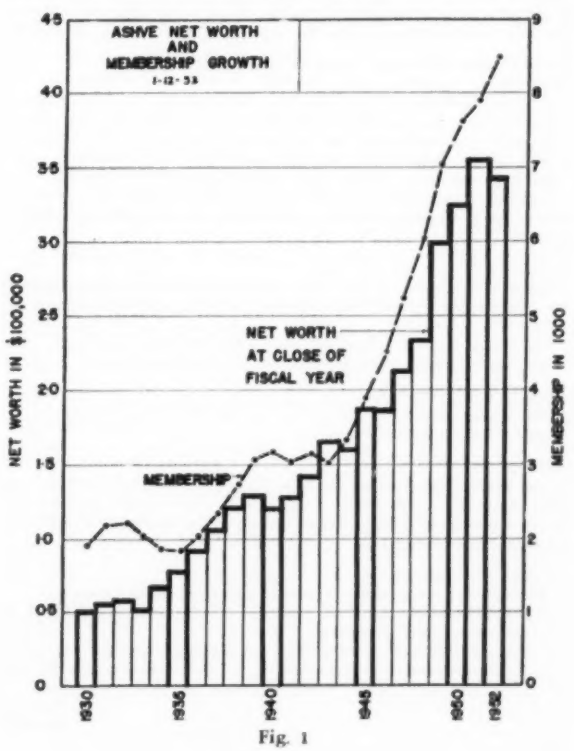


Fig. 1

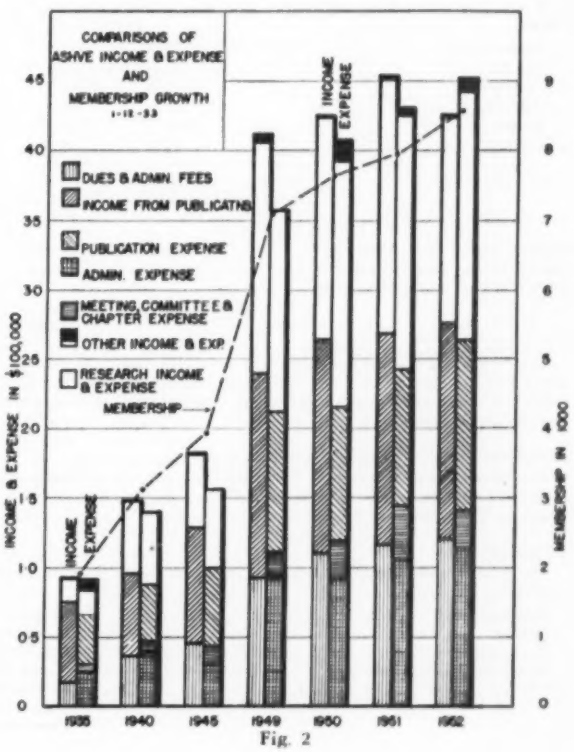


Fig. 2

JOURNAL SECTION

Accountant's Report

Frank G. Tusa & Co.
Certified Public Accountants
37 Wall St.
New York 5, N. Y.

THE AMERICAN SOCIETY OF HEATING
AND VENTILATING ENGINEERS

62 Worth Street,
New York, N. Y.

Gentlemen:

Pursuant to your request, we examined the books of account and records of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS — New York, N. Y. and Cleveland and its related funds for the fiscal year ended October 31, 1952 and submit herewith our report.

The audit covered a verification of the Assets and Liabilities as of the close of business October 31, 1952. For the fiscal year then ended, the recorded cash receipts were traced into the depositories; the cancelled bank checks were inspected and compared with the record of cash disbursements, and the disbursements were supported by payment vouchers. The dues from members and the interest from investments were accounted for.

A balance sheet reflecting the financial condition of the Society as of the close of business October 31, 1952 is submitted herewith and your attention is directed to the following comments thereon:

CASH

The cash on deposit was verified by direct communication with commercial and savings banks and the balances reported to us were reconciled with those reflected by the books of the Society. A schedule of cash is included as a part of this report.

Checks representing the cash on hand for deposit were inspected by us and the cash on hand was counted.

MARKETABLE SECURITIES

The securities shown on the subjoined schedule were verified by direct communication with the Bankers Trust Co., where same are deposited for safe-keeping. Securities have been included in the accompanying balance sheet at the cost of acquisition plus the accumulated and accrued interest earned thereon.

ACCOUNTS RECEIVABLE

Trial balances taken of the membership dues receivable and sundry debtors as of the close of business October 31, 1952 were classified and aged as follows:

MEMBERSHIP	1951	1952	TOTAL
Members	$ 17.16	$ 3,209.81	$ 3,226.97
Associates	161.75	4,427.48	4,589.23
Affiliates		1,098.25	1,098.25
Juniors	5.00	2,182.72	2,187.72
Students	6.00	63.00	69.00
TOTALS	$189.91	$10,981.26	$11,171.17

SUNDRY DEBTORS

Unpaid Charges made during 1952	$4,678.71
Unpaid Charges made during 1951	184.37
Unpaid Charges made during 1950	742.04
	$5,605.12

After writing off all receivables known to be uncollectible, it is our opinion that the reserves for dues and accounts receivable doubtful of collection reflected in the accompanying balance sheet are ample to cover collection losses that may be incurred.

RESEARCH FUND ACCOUNT RECEIVABLE

The balance due to the Research Fund from the Society as at October 31, 1952 represents the balance of 40 percent of dues receivable from Members, Associates and Affiliates as of such date.

INVENTORIES

The following inventories were verified either by count or direct communication:

Transactions	$ 5,413.57
Emblems	359.84
Guide Paper	6,670.86
Membership Roll Paper	225.00
	$12,669.27

A schedule of Transactions inventoried follows:

Volume	Year	Quantity	Price	Amount
1-49	1895-1943	3,266	$ .40	$1,306.40
50	1944	169	1.82	307.58
51	1945	335	1.91	639.85
52	1946	410	1.67	684.70
53	1947	144	1.77	254.88
54	1948	782	1.78	1,391.96
55	1949	410	2.02	828.20
				$5,413.57

PERMANENT ASSETS

The land and buildings, instruments, equipment and furniture and fixtures are reflected on the balance sheet at cost of acquisition. With the exception of land and buildings all assets have been depreciated at the rate of 10 percent per Annum. During the year fully depreciated furniture and fixtures in the amount of $37.88 was written off against the reserve.

In accordance with the resolution adopted by the Council at its meeting of January 23, 1949 depreciation was not provided on the buildings for the current fiscal year.

TAXES

The sum of $1,275.85 represents Federal income taxes withheld from employees salaries during the month of October, 1952.

DEFERRED INCOME

The prepaid dues and initiation fees by members and candidates for membership have been deferred to future operations. The membership classification of the dues prepaid by elected members follows:

MEMBERSHIP	AMOUNT
Members	$ 358.04
Associates	70.37
Affiliates	209.25
Juniors	563.30
Students	43.50
TOTAL	$1,244.46

RESERVE FOR TRANSACTIONS

Out of the original $12,500.00 reserve for TRANSACTIONS Volume 56 there remains an unexpended balance of $3,341.91. The reserve of $12,000.00 provided for Volume 57 in the 1952 budget is also reflected in the accompanying balance sheet. It is recommended that the amount in this reserve be increased inasmuch as the printing and distribution of Volume 55 exceeded $16,000.00.

RESERVE FOR BUILDING MAINTENANCE

On October 11, 1952 the Council voted:

"That disbursements be made from the Building and Maintenance Reserve Fund as authorized by the Building Committee for major items of repair and maintenance, but any balance remaining in the fund beyond the expenditures for each year would go into reserve until the Building Maintenance Reserve Fund reached a total of $10,000.00."

Inasmuch as there were no disbursements authorized as at the end of the current fiscal year, there exists a reserve balance of $2,000.00 as at October 31, 1952.

FUNDS

There is included as a part of this report an analysis of funds reflecting the changes that occurred therein during the fiscal year ended October 31, 1952.

On January 27, 1952 the Council created a Building Fund which is reflected on the balance sheet submitted as a part of this report.

DEPOSITS RECEIVABLE

The deposit placed with the United Airlines in the sum of $425.00 was verified by direct communication.

ADVANCES

The indebtedness from employees in New York and Cleveland represents advances to the employees retirement plan in the sums of $1,509.43 and $976.97 respectively. This indebtedness is to be reimbursed by the trust during the ensuing fiscal year.

DEFERRED CHARGES

The following prepayments have been deferred to future expenses:

H.P.A.C. Subscription	$2,717.55
Advertising Sales Promotion	1,350.00
Insurance Premiums — New York	517.92
Insurance Premiums — Cleveland	3,443.37
	$8,028.84

INSURANCE

The insurance coverages of the Society follow:

FIRE		
Building (Cleveland)		$200,000.00
Personal Property:		
Cleveland	$100,000.00	
New York	25,500.00	
Printers	12,000.00	137,500.00
SPRINKLER LEAKAGE		
Waverly Press	10,000.00	
Hawes and Petit	2,000.00	12,000.00
NON-OWNERSHIP — AUTOMOBILE — COMPREHENSIVE		
Public Liability		100/300M
Property Damage		5M
Medical		1M
GENERAL PUBLIC LIABILITY — PREMISES		
New York and Cleveland		
Liability		100/300M
Bodily Injury		25/100M
COMMERCIAL BLANKET BOND		
All employees including the President, Treasurer and Chairman of the Finance Committee		20,000.00

Respectfully submitted,

FRANK G. TUSA & CO.
Certified Public Accountants

BALANCE SHEET

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
New York, N. Y. — October 31, 1952

ASSETS

GENERAL FUNDS			
SOCIETY ASSETS			
CASH			
On Hand and on Deposit			$61,623.73
SECURITIES			
At Cost (Market Value $3,705.00)		$3,782.36	
Add: Accrued Interest		27.50	3,809.86
ACCOUNTS RECEIVABLE			
Membership Dues	$11,171.17		
Less: Reserve for Doubtful	6,702.70	4,468.47	
Advertisers and Sundry Debtors	5,605.12		
Less: Reserve for Doubtful	1,000.00	4,605.12	
Initiation Fees		55.00	9,128.59
INVENTORIES			12,669.27
DEPOSIT WITH UNITED AIRLINES			425.00
ADVANCES TO EMPLOYEES			
PENSION TRUST			1,509.43
DEFERRED CHARGES			4,585.47
TOTAL SOCIETY GENERAL FUND ASSETS			$ 93,751.35
RESEARCH ASSETS			
CASH			
On Hand and on Deposit			25,689.62
ACCOUNTS RECEIVABLE			
40% of Dues	4,206.41		
Less: Reserve for Doubtful	2,139.47	2,066.94	
Due from U. S. Navy Department		5,037.83	
Hospitalization — Employees		9.85	
Miscellaneous		15.00	7,129.62
ADVANCES TO EMPLOYEES			
PENSION TRUST			976.97
DEFERRED CHARGES			3,443.37
TOTAL RESEARCH GENERAL FUND ASSETS			37,239.58
TOTAL ASSETS — COMBINED GENERAL FUNDS			$130,990.93
PROPERTY FUND			
Land and Buildings		$84,920.96	
Less: Reserve for Depreciation		3,908.07	$81,012.89
Laboratory and Equipment (Cleveland)		62,816.01	
Less: Reserve for Depreciation		29,934.06	32,881.95
Furniture and Fixtures (New York)		12,386.34	
Less: Reserve for Depreciation		3,761.49	8,624.85
Library (Cleveland)			300.00
Tools (Cleveland)			300.00
			123,119.69
BUILDING FUND			
CASH			
On Hand and on Deposit			536.53
SECURITIES			
At Cost (Market Value $36,110.20)		$32,008.25	
Add: Accumulated and Accrued Interest		3,638.25	35,646.50
			36,183.03
RESERVE FUND			
Cash on Deposit			19,841.12
Securities at Cost (Market Value $64,601.77)		53,631.50	
Add: Accumulated Interest		10,970.27	64,601.77
			84,442.89
ENDOWMENT FUNDS			
F. PAUL ANDERSON FUND			
Cash on Deposit			195.91
Securities at Cost (Market Value $964.00)		1,000.00	
Add: Accrued Interest		12.50	1,012.50
			1,208.41
RESEARCH FUND			
Cash on Deposit			704.10
RESEARCH RESERVE FUND			
Cash on Deposit			10,338.30
			$386,987.35

LIABILITIES

GENERAL FUND			
FEDERAL WITHHOLDING TAXES		$ 1,275.85	
DUE RESEARCH		2,066.94	
ACCRUED ACCOUNTS			
Salaries and Commissions	$10,440.13		
Professional Fees	1,000.00	11,440.13	
DEFERRED INCOME			
Prepaid Membership Dues:			
Elected Members	$1,244.46		
Candidates	1,003.50	2,247.96	
Prepaid Admission Fees		2,250.00	
Junior Student Member Award		100.00	4,597.96
RESERVE FOR PUBLICATIONS			
Transactions — Volume 56		3,341.91	
Transactions — Volume 57		12,000.00	15,341.91 $ 34,722.79
RESEARCH FUND			
RESERVE FOR BUILDING MAINTENANCE		2,000.00	
DEFERRED INCOME			
Sound Energy Studies		574.39	
Periodic Heat Flow Through Roofs		1,850.00	
Summer Infiltration		1,850.00	
Sorption		2,000.00	6,274.39 8,274.39

FUNDS

Society General Fund	59,028.56	
Research General Fund	28,965.19	
Property Fund	123,119.69	
Building Fund	36,183.03	
Society Reserve Fund	84,442.89	
F. Paul Anderson Fund	1,208.41	
Research Endowment Fund	704.10	
Research Reserve Fund	10,338.30	343,990.17
		$386,987.35

JOURNAL SECTION

STATEMENT OF INCOME AND EXPENSES

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
New York, N. Y.
For the Fiscal Year Ended October 31, 1952

INCOME

INCOME FROM DUES				
104 MEMBERS	$83,685.50			
Less: Cancellations	1,488.25	$82,197.25		
Less: 40% to Research Fund		32,878.90	$ 49,318.35	
105 ASSOCIATES	57,131.25			
Less Cancellations	3,095.75	54,035.50		
Less: 40% to Research Fund		21,614.20	32,421.30	
105A AFFILIATES	14,125.00			
Less: Cancellations	193.75	13,931.25		
Less: 40% to Research Fund		5,572.50	8,358.75	
106 JUNIORS		24,944.50		
Less Cancellations		1,260.75	23,683.75	
107 STUDENTS		231.00		
Less: Cancellations		448.50	(217.50)	
TOTAL DUES				$113,564.65
OTHER INCOME				
108—Admission Fees			7,243.00	
109—Emblems			626.88	7,869.88
INCOME FROM PUBLICATIONS				
115—Journal Contract			23,500.00	
300—Guide			126,846.41	
117—Transactions			1,159.25	
118—Books, Reprints and Codes			3,016.95	154,522.61
INVESTMENT INCOME				
125—Interest — Savings Banks			765.17	
126—Interest — Securities			140.69	905.86
RESEARCH				
FROM ASHVE				
40% of Members, Associates and Affiliates Dues				$ 60,065.60
FROM U. S. NAVY RESEARCH				27,061.95
CONTRIBUTIONS				
GENERAL			$19,272.94	
EARMARKED				
Received during the current fiscal year — Per Schedule	$45,321.84			
Add: Deferred from Prior Years	3,924.39	$49,246.23		
Deduct: Deferred to Future Operations		6,274.39	42,971.84	62,244.78
INTEREST EARNED				1.48
				149,373.81
TOTAL INCOME				$426,236.81

EXPENSES

COMMITTEES AND CHAPTERS — SCHEDULE F			
150—Officers Travel	2,728.52		
151—Council and Council Committee Travel	7,388.02		
164—Standards Committee Travel	55.88		
170—Admissions and Advancement Committee Travel	625.15		
172—Nominating Committee Travel	1,431.18		
173A—Chapter Speakers Travel	2,308.75		
173B—Chapters Conference Committee Travel	5,647.04		
	18,184.54		426,236.81
173C—Chapter Relations Committee	594.37		
201—ASA Membership Dues	100.00		
204—Membership Certificates	1,340.50		
205—Emblems	781.09		
206—Medals and Awards	321.49	21,321.79	
MEETINGS — SCHEDULE G			
163—Meetings	4,213.83		
327—Chapter Annual and Semi-Annual Meetings Allowances	787.47	5,001.30	
PUBLICATIONS — SCHEDULE H			
200—Members Subscriptions to HPAC	15,876.54		
202—Transactions	15,006.26		
203—Membership Roll	8,888.08		
208—Books, Reprints, Codes, Charts, etc.	2,499.54		
305—Guide	81,201.60	123,472.02	
HEADQUARTERS — SCHEDULE I			
210—Salaries — Secretary and Staff	71,132.46		
210A—Social Security Taxes	897.85		
211—Public Relations	4,842.00		
212—Traveling—Secretary and Staff	2,581.06		
213—Rent and Light	11,254.98		
214—Telephone	2,008.66		
215—Telegraph	615.12		
216—Postage	5,279.84		
217—Printing and Stationery	6,622.69		
219—Addressing and Address Changes	366.27		
220—Professional Services	3,363.98		
221—Bank Charges	49.12		
222—Insurance	236.67		
11—Depreciation — Furniture and Fixtures	1,127.11		
223—Office Expenses	2,796.67		
224—Pension	1,096.51	114,270.99	
FUND RAISING — SCHEDULE K			
350—Salaries and Fees	12,012.93		
351—Travel	594.75		
352—Printing	897.58		
354—Postage and Miscellaneous	229.63	13,734.89	
RESEARCH — SCHEDULE J			
COMMITTEE EXPENSES			
Committee Travel	2,830.00		
Chairman and Executive Committee Travel	1,439.59	4,269.59	
STAFF SALARIES			
Administrative, Engineering and Technical	51,812.48		
Clerical	12,360.00		
Pensions	1,217.29		
Part Time	13,382.03		
Consulting Services	925.67		
Social Security	1,074.12	80,771.59	
LABORATORY EXPENSES			
General Staff Travel	3,271.42		
Society Meeting Travel	1,982.99		
Postage	536.80		
Telephone and Telegraph	1,741.65		
Office Supplies and Printing	942.40		
Mimeographing and Blue Prints	2,222.68		
	10,697.94	85,041.18	149,373.81
Library and Reprints	491.35		
Professional Services	438.72		
Workmen's Compensation Insurance	257.98		
Laboratory Materials and Supplies	4,181.88		
Depreciation of Equipment	5,936.52	22,004.39	

BUILDING OPERATIONS AND MAINTENANCE			
Power	2,725.45		
Heating	1,393.37		
Water	29.24		
Janitors Wages	2,817.69		
Janitors Supplies	305.56		
Building Maintenance	789.88		
Building Insurance	1,451.14	9,512.33	
PROVISION FOR BUILDING MAINTENANCE RESERVE		2,000.00	
U. S. NAVY RESEARCH			
Staff Salaries	12,665.78		
Staff Travel	281.39		
Materials and Supplies	2,524.87		
Equipment	2,367.79	17,839.83	
COOPERATIVE RESEARCH AGREEMENTS			
Case Institute of Technology	2,500.00		
Columbia University	500.00		
Kansas State College	3,200.00		
Northwestern University	4,000.00		
University of Florida	1,500.00		
University of Illinois	6,500.00		
University of Minnesota	4,454.52		
California Institute of Technology	5,000.00		
Michigan State College	800.00		
University of Pittsburgh	2,000.00	28,454.52	164,852.25
		165,474.47	443,275.46
NET LOSS			(17,038.65)
OTHER DEDUCTIONS			
Admission Fees Allocated to Reserve Fund		7,243.00	
Uncollectible Accounts Receivable Written Off		440.99	
Uncollectible Dues Written Off		1,811.54	
		9,495.53	
OTHER INCOME			
Income from Fluctuation Canadian Exchange		670.71	8,824.62
EXCESS OF EXPENSES OVER INCOME			($25,863.27)

BUDGET COMPARISON — CASH RECEIPTS

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

New York, N. Y. — For the Fiscal Year Ended October 31, 1952

DUES — SCHEDULE A CURRENT MEMBERS	Actual	Budget Provision	Increases	Decreases
6A—Members	$ 44,665.90	$ 43,200.00	$ 1,465.90	
6B—Associates & Affiliates	36,402.93	40,500.00		$ 4,097.07
6C—Juniors	18,483.15	19,500.00		1,016.85
6D—Students	481.40	800.00		318.60
	100,033.38	104,000.00	1,465.90	5,432.52
NEW MEMBERS				
104—Members	2,773.50	1,800.00	973.50	
105—Associates & Affiliates	3,030.30	2,100.00	930.30	
106—Juniors	3,512.04	2,000.00	1,512.04	
107—Students	163.00	150.00	13.00	
	9,478.84	6,050.00	3,428.84	
PRIOR YEARS DUES				
6E—Members	1,232.46	1,800.00		567.54
6F—Associates & Affiliates	1,765.31	2,700.00		934.69
6G—Juniors	555.97	500.00	55.97	
6H—Students	144.00	100.00	44.00	
	3,697.74	5,100.00	99.97	1,502.23
TOTAL DUES	113,209.96	115,150.00	4,994.71	6,934.75
108—Admission Fees	5,615.00	5,500.00	115.00	
108A—Admission Fees Prepaid	2,180.00	250.00	1,930.00	
	7,795.00	5,750.00	2,045.00	
DEFERRED INCOME				
6I—Prepaid Dues by Members	494.34	200.00	294.34	
6J—Prepaid Dues by Candidates	926.50	800.00	126.50	
	1,420.84	1,000.00	420.84	
PUBLICATION—SCHEDULE B				
115—Journal Contract	23,500.00	23,500.00		
300—Guide Advertising	78,146.45	75,800.00	2,346.45	
302—Guide Copy	50,892.09	53,700.00		2,807.91
117—Transactions	878.75	1,750.00		871.25
118—Books, Reprints, Codes, etc.	3,355.38	1,750.00	1,605.38	
	156,772.67	156,500.00	3,951.83	3,679.16

BUDGET COMPARISON — CASH DISBURSEMENTS

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

New York, N. Y. — For the Fiscal Year Ended October 31, 1952

	Actual	Budget Provision	Increases	Decreases
COMMITTEES AND CHAPTERS—SCHEDULE F				
150—Officers Travel	$ 2,728.52	$ 4,000.00	$	$ 1,271.48
151—Council and Council Committee Travel	7,388.02	8,000.00		611.98
164—Standards Committee Travel	55.88	750.00		694.12
170—Admission and Advancement Committee Travel	625.15	600.00	25.15	
171—Charter and By-Laws Committee Travel	—0—	500.00		500.00
172—Nominating Committee Travel	1,431.18	2,000.00		568.82
173A—Chapter Speakers Travel	2,308.75	2,500.00		191.25
173B—Chapters Conference Committee Travel	3,647.04	5,000.00		1,352.96
173C—Chapter Relations Committee	594.37	600.00		5.63
175—Building Committee Travel	—0—	300.00		300.00
201—A.S.A. Membership Dues	100.00	100.00		
204—Membership Certificates	1,340.30	700.00	640.30	
205—Emblems	625.99	250.00	375.99	
206—Medals and Awards	295.70	350.00		54.30
	21,140.90	25,650.00	1,041.44	5,550.54
MEETINGS—SCHEDULE G				
163—Meetings	4,213.83	4,000.00	213.83	
327—Chapter Meeting Allowance	787.47	2,000.00		1,212.53
	5,001.30	6,000.00	213.83	1,212.53
PUBLICATIONS—SCHEDULE H				
200—Journal Subscriptions	16,003.59	17,000.00		996.41
202—Transactions Volumes 55-57	17,479.72	12,000.00	5,479.72	
203—Membership Roll	9,113.08	7,200.00	1,913.08	
208—Books, Reprints, Codes, etc.	2,499.54	1,500.00	999.54	
GUIDE				
305-309—Printing and Binding	43,835.79	37,500.00	6,335.79	
315-316—Advertising and Sales Promotion	21,866.64	22,000.00		133.36
320-322—Copy Sales Promotion	13,103.12	12,000.00	1,103.12	

BUDGET COMPARISON — CASH RECEIPTS *(continued)*

INVESTMENT—SCHEDULE C				
125—Interest—Savings Banks	990.70	800.00	190.70	
126—Interest—Securities	674.72	800.00		125.28
	1,665.42	1,600.00	190.70	125.28
OTHER RECEIPTS—SCHEDULE D				
109—Emblems	442.50	500.00		57.50
RESEARCH LABORATORY RECEIPTS SCHEDULE E				
40% of Members, Associates and Affiliates Dues	59,913.58	61,400.00		1,486.42
Contributions—General	19,272.94	15,000.00	4,272.94	
Contributions—Earmarked	45,321.84	45,000.00	321.84	
Navy Contract	25,470.36	34,260.00		8,789.64
Interest	614.79	250.00	364.79	
From Reserve	25,000.00	25,000.00		
	175,593.51	180,910.00	4,959.57	10,276.06
TOTAL RECEIPTS	$456,899.90	$461,410.00	$16,562.65	$21,072.75

BUDGET COMPARISON — CASH DISBURSEMENTS *(continued)*

325—Guide Committee Travel	1,705.45	1,400.00	305.45	
	125,606.93	110,600.00	16,136.70	1,129.77
HEADQUARTERS—SCHEDULE I				
210—Salaries	$ 72,175.51	$ 79,200.00	$	$ 7,024.49
210A—Social Security Tax	897.85	1,000.00		102.15
211—Public Relations	4,842.00	5,500.00		658.00
212—Travel—Secretary and Staff	2,581.06	2,600.00		18.94
213—Rent and Light	11,254.98	11,200.00	54.98	
214—Telephone	2,008.66	2,000.00	8.66	
215—Telegraph	615.12	500.00	115.12	
216—Postage	5,315.86	5,000.00	315.86	
217—Printing and Stationery	6,622.69	6,000.00	622.69	
219—Addressing and Address Changes	366.27	500.00		133.73
220—Professional Services	3,363.98	3,000.00	363.98	
221—Bank Charges	49.12	100.00		50.88
222—Insurance	341.22	1,000.00		658.78
11—Furniture and Fixtures	2,286.02	2,000.00	286.02	
223—Office Expense (Miscellaneous)	2,796.67	2,000.00	796.67	
224—Pension	1,176.28	1,000.00	176.28	
	116,693.29	122,600.00	2,740.26	8,646.97
RESEARCH				
Research Committee Expenses	4,269.59	5,000.00		730.41
Staff Salaries	80,771.59	87,170.00		6,398.41
Laboratory Expenses	22,966.81	24,600.00		1,633.19
Laboratory Operation and Maintenance	12,747.90	10,300.00	2,447.90	
Provision for Building Maintenance	2,000.00	2,000.00		
Research Contracts and Fellowships	28,454.52	27,000.00	1,454.52	
Navy Research	17,839.83	24,840.00		7,000.17
	169,050.24	180,910.00	3,902.42	15,762.18
FUND RAISING—SCHEDULE K				
Salaries and Fees	12,012.93	11,700.00	312.93	
Travel	594.75	1,000.00		405.25
Printing	897.58	2,500.00		1,602.42
Postage and Miscellaneous	229.63	1,200.00		970.37
	13,734.89	16,400.00	312.93	2,978.04
TOTAL DISBURSEMENTS	$451,227.55	$462,160.00	$24,347.58	$35,280.03

Tellers of Election

The chairman appointed the following tellers of election: W. G. Boales, Detroit, W. H. Old, Detroit, and G. V. Zintel, Chicago.

After calling attention to the rules for technical sessions, First Vice Pres. Reg F. Taylor introduced Tohru Inouye, who presented the paper, A Comparison of Physiological Adjustments of Clothed Women and Men to Sudden Changes in Environment, by Tohru Inouye, F. K. Hick, M.D., R. W. Keeton, M.D., J. Losch, and Nathaniel Glickman (to be published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

L. T. AVERY, Cleveland, Ohio, pointed out that this paper was of tremendous importance because it proved that fears of shock or strain due to entering or leaving air conditioned spaces in summer had no basis in any physiological fact. This is due to the ability of the human body to make the necessary adjustments without strain.

Mr. Avery also stated that it would be impossible for human beings to have even a tolerable feeling of comfort at 81 percent relative humidity and 76 F temperature unless they were kept completely at rest.

PROF. NATHANIEL GLICKMAN, Miami Beach, Fla., stated that this paper completed one phase of the studies at the University of Illinois on the physiological adjustments of human beings to sudden changes in ambient temperature and humidity. He pointed out that women have a lower mean skin temperature than men at the lower ambient temperature because they have a greater amount of subcutaneous fat, which affords a greater tissue insulation. It is interesting to note, however, that at higher ambient temperatures women are able to reduce this tissue insulation and have a higher mean skin temperature than men.

From the tests conducted at the University of Illinois it has been learned that both men and women are able to adjust rapidly and with very little strain on the cardio-vascular system.

Professor Glickman referred to previous tests in which the same men were subjected to sudden changes in temperature in summer and in winter. In these tests no evidence was found to indicate any seasonal adaptation to cold temperatures.

With reference to Mr. Avery's comment, Professor Glickman stated that experiments should be conducted to determine the response of individuals to sudden changes in temperature when doing light work.

The second technical paper, Two Methods of Calculating Friction Heads for Pipe Lines, by F. E. Giesecke (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December, 1952) was presented by C. M. Humphreys, Cleveland, Ohio, due to the illness of the author.

G. V. PARMELEE, Cleveland, Ohio, made the comment that the work of J. R. Freeman on friction loss in elbows, to which Dr. Giesecke has referred, had also been found very useful in laboratory studies on elbow friction loss.

The chairman then introduced M. W. Bishop, president of Illinois Chapter, who welcomed the members and guests to the 59th Annual Meeting sponsored by Illinois Chapter, the oldest chapter in the Society. Mr. Bishop introduced W. A. Kuechenberg, general chairman of the Committee on Arrangements, and Vice

F. Paul Anderson Medal awarded to E. N. McDonnell

Chairman G. W. Bornquist. He gave credit to both for the work of organizing committees and making arrangements for the Annual Meeting.

Second Vice Pres. L. N. Hunter, responded to Mr. Bishop's welcome, and thanked the Chapter in the name of the Society.

The chairman asked Mr. Kuechenberg to introduce Dr. Preston Bradley of Chicago, who gave an inspirational talk on the subject, *Today — Tomorrow and You*. Chairman Taylor thanked the authors and Dr. Bradley, and adjourned the meeting at 11:45 a.m.

SECOND SESSION, TUESDAY, JANUARY 27, 9:30 A.M.

Treas. J. Donald Kroeker called the meeting to order at 9:30 a.m. in the Grand Ballroom of the Conrad Hilton Hotel.

W. G. Boales presented the Report of the Tellers of Election as follows:

Report of Tellers of Election

BALLOT FOR OFFICERS:	Total
President	
Reg F. Taylor, Houston, Tex.	1853
First Vice President	
L. N. Hunter, Johnstown, Pa.	1853
Second Vice President	
John E. Haines, Minneapolis, Minn.	1840
Treasurer	
John W. James, Chicago, Ill.	1853
MEMBERS OF COUNCIL (*three-year term*)	
I. W. Cotton, Indianapolis, Ind.	1851
A. W. Edwards, Cincinnati, Ohio	1852
L. T. Mart, Kansas City, Mo.	1852
E. R. Queer, State College, Pa.	1852
MEMBER OF COUNCIL (*one-year term*)	
Bruce L. Evans, St. Louis, Mo.	1852
COMMITTEE ON RESEARCH (*three-year term*)	
R. S. Dill, Washington, D. C.	1850
F. H. Faust, Bloomfield, N. J.	1852
A. J. Hess, Los Angeles, Calif.	1851
H. A. Lockhart, Morton Grove, Ill.	1852
J. W. McElgin, Philadelphia, Pa.	1852
Total Ballots Received	1858
Total Legal Ballots	1853
Invalid Ballots	5

Scattering votes: 2nd Vice President 15; Members of Council 5; Committee on Research 8.

Respectfully submitted,
W. G. BOALES, *Chairman*
W. H. OLD
G. V. ZINTEL

Chairman Kroeker announced that the new officers, members of the Council and members of the Committee on Research would be installed at the final session on Thursday, January 29.

Mr. Kroeker reminded the members that the 8th Oregon State Air Conditioning Conference would be held in conjunction with the Pacific Northwest Heating and Air Conditioning Exposition on March 18, 19 and 20 in Portland, Ore. A cordial invitation was extended to all members to attend the meeting.

The first technical paper, Compression Tank Selection for Hot Water Heating Systems, by H. A. Lockhart and G. F. Carlson (to be published in the ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April, 1953) was presented by Mr. Lockhart.

Discussions of the paper were given by R. C. Chewning, Portland, Ore., Martin Christesen, Englewood, N. J., and J. W. James, Chicago, Ill. A written discussion has been received from N. D. Skinner, Indianapolis, Ind. These discussions, together with the Author's Closure, will be printed with the paper.

The second technical paper, The Bacteria and Odor Control Problem in Occupied Spaces, by R. L. Kuehner (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December, 1952) was presented by Dr. Kuehner.

Written discussions submitted by H. C. Murphy and Dr. Ralph G. H. Siu were read by Mr. Flink.

H. C. MURPHY, Carmel, Calif. (WRITTEN): Dr. Kuehner's paper is a definite contribution to our work in establishing standards in two important phases of air sanitation. However, in addition to the study of bacterial and odor contamination, I believe we will eventually find it desirable to investigate further the electrical properties of the lower atmosphere.

Dr. Theodore Puck of the University of Colorado Medical Center reported to the 1950 meeting of the *American Chemical Society* that viruses apparently must carry an electrical charge in order to attack living cells. It appears that if the cells already carry a certain charge, the virus is incapable of becoming attached to it.

We know too little about the electrical characteristics of the air we breathe. In most of the studies reported it appears that positive ions outnumber the negative ions, especially in places of public assemblage. It is possible that electric heaters, electrostatic air cleaners, and similar devices which liberate positive and negative ions may alter significantly the ionic content of occupied spaces. A number of investigators in this country and abroad are of the opinion that a preponderance of positive ions in the air we breathe has a depressing effect on the occupants while negative ions give a feeling of well being. Work on this subject is under way at several schools in this country.

R. G. H. SIU*, Washington, D.C. (WRITTEN): The paper by Dr. Kuehner has analyzed quite clearly the difficulties connected with measuring the effectiveness of bacterial and odor control. He has done a very good job in pointing out areas to which energies should be directed.

The general procedure outlined for quantitatively expressing the amount of odor by *thresholds* is sound. Yet I believe it should be related to a definite quantitative value for a given odor. To say that *the odor concentration in the original air was 2 thresholds as compared to one threshold in the purified air* provides a relative measure

*Department of the Army, Office of the Quartermaster General.

of the effectiveness of the purification processes. However, it would be difficult to compare the effectiveness measured by different individuals *unless* the individuals respond to the same thresholds. Let us take an illustrative example: If test subject A is sensitive to 4 ppm of H_2S, the amount of H_2S removed in the example given above will be equal to 8 minus 4, or 4 ppm. If test subject B is sensitive to 1 ppm of H_2S, then the amount of H_2S removed in the same example would be 2 minus one, or 1 ppm. In both cases the concentrations were reduced from 2 to 1 threshold. But the quantity of H_2S removed (and hence the purification efficiency) varied by a factor of four. It seems as if the test subjects themselves must first be calibrated against absolute amounts of odor material so that only those individuals sensitive to a standard threshold concentration will be used.

An interesting point was brought up by Dr. Kuehner in using xylene to check the sensitivity of its subjects. In the selection of the chemicals for such calibration, cognizance must be paid to avoiding those which numb the smelling senses. Some of the hydrocarbons have that capacity. I am not sure whether xylene belongs to the group.

The section on bacterial control has also been well done. The difficulties in adopting a standard of measurement in bacterial control resemble those in odor in that, in both cases, there are many different varieties. Dr. Kuehner pointed out, and rightly so, that attention must be given not only to the measurement of bacterial population as such, but specifically the pathogenic type. He mentions the diphtheria and pus-forming organisms. I was wondering whether, at the beginning anyway, the engineering profession should not be content to standardize on methods in which total bacterial counts are made, rather than venture into the difficult task of separation of organisms and identification of specific types. Furthermore, the selection of the particular pathogene to be considered would require quite a bit of deliberation.

If total bacterial population is to be determined, the use of simplified manometric procedures might be considered worthwhile as a substitute for plate counts on agar. The manometric technique using respiration as an index of growth has been worked over quite a bit in other fields and, consequently, the time is ripe for the engineering profession to exploit the knowledge.

I believe the most immediate action called for by Dr. Kuehner's paper is a tentative agreement by the profession on at least one method as a point of departure. Dr. Kuehner's paper shows very well that such a method can be described at this time, provided the desire is there.

N. E. Berry, Evansville, Ind. (Written): In the preparation and presentation of his paper on The Bacteria and Odor Control Problem in Occupied Spaces, Dr. Kuehner has made a significant contribution to the long-term progress of the air conditioning industry. His description and discussion of the basic techniques available for bacteria and odor control work should be of positive value to those already active in this field and should provide a stimulus to others to initiate research work of this type.

I want to congratulate Dr. Kuehner particularly on his objectivity in evaluating the accuracy of the techniques and of the data obtained. It is only through such painstaking research that we shall ever get solid ground under our feet in this phase of our industry. It is to be hoped that investigation of other possible components of air quality will be conducted on a similarly high scientific level.

With regard to the data presented, it occurred to me that there might be some misunderstanding of the results presented in Table 1. The third column is labeled, *ml N/10 Oxidant Reduced per gram Tobacco Burned*. In the case of total absorption the results are quite straightforward. However, in the two latter cases where partial sampling was used, the values are apparently calculated, taking into account the known percentage of the total smoke odor that was actually passed through the absorption train. Perhaps this is too obvious to deserve comment, although I must confess it was not immediately so to me on first reading.

Dr. Kuehner does not tell us how to solve our odor problems, but he does give us some valuable insight into what is going to be necessary in the way of research if we are to solve them. I have no doubt that this paper will be of particular interest to those in our Society's Research Laboratory who are just beginning this type of investigation.

Although my personal inclinations are often toward basic research work with very precise results as the ultimate objective, I cannot resist this opportunity to emphasize the need for obtaining at least partial practical answers as we go along. Perhaps it is too much to expect both kinds of results from the same investigative group, although I believe something of this sort should and will be achieved in the Research Laboratory work.

In conclusion I would like to repeat by way of emphasis, one sentence in Dr. Kuehner's paper. *The future demands that this industry assume the responsibility for air conditioning in its broadest sense.* I believe with Dr. Kuehner that we must accept this responsibility, not necessarily as a duty to our fellow men, but as a challenging business opportunity. One does not have to be prophetic to know that in the years to come we are going to be doing things to air that are even beyond our present dreams. Certainly, then, we must move forward with all possible speed to practical solutions for those problems we have with us today and which we can all readily recognize without resort to dreaming.

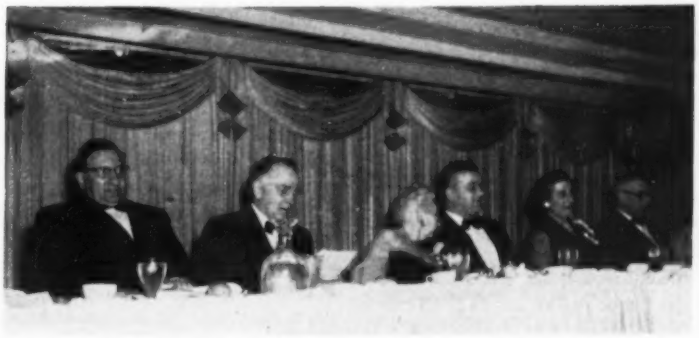
G. W. Meek, New York, N.Y. (Written): Both the author and his employer are to be congratulated — the author for the scholarly and painstaking manner in which he has carried out his studies, and his employer for having the vision and courage to finance work in a phase of air conditioning where ignorance is so extensive that the more timid are reluctant to enter.

It is unfortunate, however, that the paper is put forth in the form of a *teaser* — that the important findings of this research work are only suggested. As the author's bibliography shows, dilution systems and threshold measurement techniques are well known. It is also well known that certain foul smelling chemicals and certain highly corrosive chemicals have been used to kill airborne bacteria. Certain chemicals capable of partially oxidizing odorous molecules are also known. But the paper hints that non-odorous, non-corrosive bactericides and non-odorous partially effective odor oxidants have been found. Without information on these materials, which supposedly were isolated and their performance tested, this paper provides its readers with no means of checking its scientific validity. Its main value seems to be that of an interest stimulator. It merely gives the reader a hunting license and says *See if you can find out more in nine years than we did, but we won't tell you what we found.*

Three other points require comment. First, in his opening the author says, *This discussion applies to the absolute removal and destruction of bacteria and odor.* It is well to remind ourselves that what we so fondly call *fresh* air is *not* odor-free air. It is air which contains odorous molecules providing that subtle psychological effect which the human brain has learned to associate with the areas where such odorous molecules are generated — namely the great outdoors. If we remove these desirable odorous molecules and don't restore them we duplicate an error made recently by our medical colleagues. They suddenly discovered that Terramycin was so effective that it killed off all the *favorable* flora and fauna in the large intestine and that some tens of millions of friendly bacteria had to be replanted by having the patient drink a copious supply of buttermilk.

Second, certain of the author's opening remarks about odor removers and odor neutralizers might be taken to mean he feels there is no such phenomena as odor or osmic neutralization. I am sure this is not the case because the very scientist on whose ideas the author's dilution apparatus is based showed osmic neutralization to be a scientific fact and completely devoid of any implications of masking or anesthetizing.

Third, the author's emphasis on absolute destruction of odor might imply that the day of odor-free air conditioned spaces has been made practical by this new discovery. We need but to recall how odors are gen-



Banquet Head Table (*l to r*) Ernest Szekely, E. N. McDonnell, Mrs. Szekely, L. E. Seeley, Mrs. L. N. Hunter, Reg F. Taylor

erated to know that such an accomplishment is not even theoretically achievable with solely a subtractive or purely a dilution approach to odor control. Recall that in an airplane or Pullman car (two of our more smelly air-conditioned spaces) odor is *constantly* generated in the immediate vicinity of the occupant — tobacco smoke, odors from the surfaces and the openings of the human body itself, vomit, cosmetics, etc. Any system which requires that all of these odorous molecules be transported back to some central conditioner must of necessity continue to drag hundreds of millions of these same obnoxious molecules past the noses of the occupants.

In closing, may I as chairman of the Basic Research Subcommittee of your TAC on Odors invite all of you to come to New York on April 23 and 24; where, it is planned to hold a two-day symposium on Basic Odor Research. It has taken more than two years to complete plans for top ranking scientists in the fields of chemistry, physics, physiology, psychology, biology, and various branches of medicine to join in this concentrated effort to reduce the area of ignorance on this important and fascinating subject of odor. We hope you can attend.

H. B. NOTTAGE, Los Angeles, Calif. (WRITTEN): Have other arrangements of dilution systems been tried for measuring thresholds? If so, are the measurements independent of the apparatus?

Were any odors encountered which gave anomalous results by the dilution technique when compared with full-scale room measurements? If not, might this occur? Could the dilution technique be employed, for instance, to study the effect of humidity upon odors?

AMOS TURK, Danbury, Conn. (WRITTEN): A report of research results, if it is to fulfill its function as a contribution to knowledge, must be *operational* in nature. That is, other workers, *skilled in the art* must be able to reproduce the research in their own laboratory, to confirm its value and to use it as a springboard for further progress. This criterion of reportable research, development, or invention is used by the United States Patent Office and by editors of scientific journals in general. It is regrettable that this standard was not applied to this paper.

For example, the author describes a system employing an *oxidant for measuring the quantity of odor present in the . . . air.* The *concept* of oxidizing odorous vapors for analysis is old and does not merit re-publication, except in a review article. The use of new oxidants or new procedures, however, is certainly valuable and should be published. The author probably worked with some novel procedures, and, if so, their *operational* description should have been given. Also, what *deodorants* were evaluated? All of the experimental procedures and results reported in the paper are operationally deficient.

A number of incorrect statements appear in the sections on odor: *. . . there is no satisfactory progress toward their [odors] control* and *the air conditioning industry could not now by any single criterion, or group of criteria, determine which deodorant or disinfectant is better than the other, or if they have any merit at all.* On the contrary, applications of activated carbon physical and chemi-sorption, catalytic combustion, and liquid absorption, with and without chemical reaction, are all well known and certainly constitute progress toward their control. Analytic methods for evaluating efficiencies of these techniques are abundantly reported in the chemical analytical literature, and are available to the air conditioning industry. Odor dilution methods, instruments, and procedures are also described, including a recently developed modification (Air Repair Vol. 1, No. 4, 13, 1952). The literature on evaluation of disinfectants is likewise abundant.

The author confuses *odor* with *odorant*, the one being a psychological stimulus, the other a substance capable of producing such a stimulus. In this light reexamine the concept of an *oxidant for measuring the quantity of odor present in the . . . air.* All that an oxidant can *measure* is a reductant. The assumption that the chemically reducing properties of substances are directly related to their odorous qualities is incorrect, often astonishingly so. From literature reported to date, the problem of purely instrumental measurement of *odor* is still unsolved. It may well remain unsolved until the mechanism of odor perception is better understood.

SHERMAN ROSS†, College Park, Md. (WRITTEN): I should like to express my appreciation of the opportunity to comment on the paper by Dr. Kuehner describing the results of nine years of research in odor and bacteria control.

The techniques he described are of interest and the development of these should be of importance in the future. I doubt that we have here the *yard-stick* required.

I am quite sure that Dr. Kuehner was concerned with techniques which could be conducted *in an engineering manner* to deal with this complex problem of human sensitivity. I am not at all sure that he has avoided the major and determining variable of human sensitivity and human

†Associate Professor, Department of Psychology, University of Maryland.

Banquet Head Table (*l to r*) A. V. Hutchinson, Mrs. Newton, C. F. Roth, Mrs. J. W. James, Rev. Newton, Mrs. Nathaniel Leverone, J. D. Kroeker, Mrs. J. E. Haines, L. N. Hunter, Mrs. Reg F. Taylor

preference. He is searching for measurement in finite numbers with which the human factor is minimized and quantified. It is precisely this human factor for which all of the odor removal is done. In attempting to remove two important sources of variation, Dr. Kuehner makes several major assumptions and possibly several major errors. He is concerned with the removal of individual differences, and of dealing with results from observers whose agreement is extremely high.

In the dilution system he presents for measuring thresholds, we are not informed of the problem of sensory adaptation nor do we know to what degree his thresholds were influenced by the stream of diluted material used. He does not inform us of the range of individual differences which he encounters in measuring thresholds by his system or the basis for the selection of two operators (except that their thresholds agreed when measured for several odor systems). We do not know whether this sample ($n = 2$) represents high, middle, or low sensitivity when compared with the population. We might note in passing that two completely anosmic individuals would agree perfectly in their sensitivity to the various substances used. In spite of this sampling situation, Dr. Kuehner does not hesitate to suggest that *variation of the human sense of smell appears to be exaggerated.*

Regarding the use of measurements from the two *standard observers* we might comment that the treatment of these results as described is certainly unusual. The implications of discarding *divergent readings* from these observers could only bias the results used in the direction of increased reliability.

Dr. Kuehner does not indicate to us how test data are corrected when an operator's current threshold is found to be different from his usual threshold. It might be that he assumes a linear relationship between percent of correct judgments and concentration. Most certainly the notion of a linear scale here is wide open to question. It is also an interesting question to ponder on the meaning of a statement that an observer was 110 percent efficient this morning.

Dr. Kuehner has tried to get rid of complex variables, namely, individual differences in sensitivity and variability in sensitivity. It is precisely these variables in the whole measurement situation which are the most significant, and it is toward human behavior that the whole air-conditioning industry directs its efforts.

The techniques, problems, and difficulties of experimental psychological study simply cannot be assumed out of the situation, nor mistreated conceptually, when we have such a major backlog of information of useful importance.

I have tried out these comments on several of my colleagues who agree with their general flavor. I feel confident that other psychologists would concur in the opinions stated above.

LESTER T. AVERY, Cleveland, Ohio, stated that it was impossible for the Society to restrict its research work to merely the temperature and humidity aspects of air conditioning. It is evident that the Society is interested in the physiological relationship of man to his environment, and consequently will need to consider problems of odors and air concentration.

He referred to the new test rooms which had been completed in the ASHVE Laboratory for the purpose of beginning an investigation of odors.

The Author's Closure, together with these discussions will be printed with the paper in the ASHVE TRANSACTIONS, 1953.

The third technical paper, Heat Transmitted to the I=B=R Research Home from the Inside Chimney, by W. S. Harris and R. J. Martin (to be published in the ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April, 1953) was presented by Professor Harris.

Discussions of the paper were given by P. R. Achenbach and R. K. Thulman, both of Washington, D. C., and E. K. Campbell, Kansas City, Mo. They will be published with the paper together with the Author's Closure.

The fourth technical paper, Fuel Consumption Analysis for Multi-Family Housing Projects, by Rutcher Skagerberg and J. E. Phifer (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, November, 1952) was presented by Mr. Skagerberg.

M. J. REED, New York, N. Y., inquired whether the different curves on Fig. 6 applied to separate housing projects, and if so whether more than one type of fuel had been used. He also asked whether the practice with regard to night set-back of thermostats could be indicated for the various curves shown.

AUTHORS' CLOSURE: Mr. Skagerberg, in replying to Mr. Reed's questions, stated that coal was used in all projects shown on Fig. 6. The set-back of thermostats at night was not the same in all projects. The author felt that the tendency in warm climates was to have less set-back of the thermostat at night than in colder climates. Mr. Skagerberg pointed out that it was impossible to control many factors in large housing projects. Some uncontrollable factors were the amount of supplemental heat from gas ranges used during cold periods.

Chairman Kroeker thanked the authors and those who had made comments on the papers, and adjourned the meeting at 12:15 p.m.

THIRD SESSION, TUESDAY, JANUARY 27, 2:00 P.M.

Second Vice Pres. L. N. Hunter called the meeting to order at 2:00 p.m. and announced that the session would be a symposium on Research Administration.

He pointed out that research in industry and in the heating, ventilating, and air conditioning profession is becoming of greater importance as time goes on. It is apparent that the future of the profession is dependent upon the success of research and the amount of research that is carried on. The increasing popularity of research poses a number of problems, especially those of organization and administration. The administration of research had therefore been selected as the theme for the discussion to follow.

Chairman Hunter then introduced the three speakers who discussed the following phases of research administration: Participation by Colleges in Research, by E. A. Walker, Dean, School of Engineering, The Pennsylvania State College; Government Sponsored Research — A Canadian View, by R. F. Legget, Director, Division of Building Research, National Research Council of Canada; and Industrial Research in the Control of Environment, by W. H. Kliever, Director of Research, Minneapolis-Honeywell Regulator Co.

The audience was then given an opportunity to participate in the discussion. Comments were offered by H. B. Nottage, Los Angeles, Calif., Cyril Tasker, ASHVE Director of Research, Dean L. G. Miller, East Lansing, Mich., J. Donald Kroeker, Portland, Ore., I. W. Cotton, Indianapolis, Ind., R. A. Miller, Pittsburgh, Pa., and R. A. Sherman, Columbus, Ohio.

Messrs. Walker, Legget and Kliever were then given an opportunity to summarize the discussions and offered additional comment.

Chairman Hunter thanked the speakers and those who had made comments, and adjourned the meeting at 4:30 p.m. *(Proceedings to be concluded in April issue.)*

11TH Heating and Ventilating Exposition Attracts over 29,000 Visitors

The 11th International Heating, Ventilating and Air Conditioning Exposition was held at the International Amphitheatre in conjunction with the Society's meeting. With 431 exhibitors and a total attendance of over 29,000, this was the largest show of its kind ever held. One of the highlights of the Exposition was the Society's Research exhibit on the second floor. This included a display of some of the Research Laboratory projects, and a cooperative Research project at the University of Illinois. A low-resistance, low-inertia heat flow meter was shown; there was an exhibit demonstrating the effects of painted and reflective shades on light transmission; there was a demonstration by means of a potentiometer and photoelectric cell of the heat transmitting properties of various types of glass. Two large overhead aluminum panels electrically heated to the same temperature, dramatically showed the effect of low emissivity paint and its effect on radiation.

A display of cooperative research with the University of Illinois in the physiological effects of environment was shown by means of two booths 4 ft by 4 ft with transparent walls and doors. Conditions simulating those of a hot humid street in the summer were maintained in one booth, while conditions simulating those in an air conditioned home, store or office were maintained in the second room. By means of a model wearing summer attire and fitted with thermocouples attached to an indicator-recorder, a vivid demonstration of the effects of sudden change in temperature and humidity on the skin and body temperature was shown.

RESEARCH AT WORK
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
DEMONSTRATION OF
PHYSIOLOGICAL ADJUSTMENTS OF CLOTHED PERSONS TO SUDDEN CHANGES IN ENVIRONMENT
COOPERATIVE RESEARCH

View of ASHVE booth showing cooperative research at the University of Illinois

1952 Annual Report Committee on Research

I. W. Cotton, Chairman
Committee on Research

R. S. Dill, Vice Chairman
Committee on Research

I. W. Cotton, Chairman

Committee on Research

I. W. Cotton, *Chairman*; R. S. Dill, *Vice Chairman*; Cyril Tasker, *Director of Research*; C. M. Humphreys, *Senior Engineer*.

Executive Committee: I. W. Cotton, *Chairman*; R. S. Dill, *Vice Chairman*; Carl F. Boester, John Everetts, Jr., C. O. Mackey.

Three Years: I. W. Cotton, W. A. Grant, N. B. Hutcheon, B. H. Jennings, C. O. Mackey.

Two Years: A. B. Algren, John Everetts, Jr., R. W. Keeton, M.D., T. H. Smoot, W. N. Witheridge.

One Year: Carl F. Boester, R. C. Cross, R. S. Dill, A. J. Hess, H. A. Lockhart.

During the operating year 1952, now closing, Society research was concerned with 13 active projects at the Laboratory and 14 projects at 12 cooperating institutions. The Report of the Director of Research which forms a part of this report gives details of these activities. The map, Fig. 1, shows the locations of the institutions cooperating with the Society during 1952.

There were three meetings of the Committee on Research, three meetings of the Research Executive Committee and a total of 24 meetings of Technical Advisory Committees — with a total attendance of over 240 Committee members and over 200 guests.

Papers prepared for publication and accepted numbered 13. During the year the Laboratory staff organized its own screening and editing system in the effort to make papers and progress reports readily readable and with effective summarizing — but with no sacrifice of the comprehensive technical detail necessary for a complete presentation.

The Director recognizes in his portion of the report the fact that papers do not constitute the end objective of research — rather, they represent the first step in the real job of getting information to our membership and the public in definitely useable form. Continued effort will improve the presentations.

During the year another important Laboratory facility has been substantially completed — the two odor-test rooms (Fig. 2) with connecting corridor being nearly ready for operation in the launching of the projected odor studies. This structure joins the Environment Laboratory on the main floor of the Research Laboratory as an important capital addition, with a decided difference, however, in objectives and scope.

The Environment Laboratory has already proved its practicability in the assembly and tabulation of much needed data regarding heat exchange between panels and the enclosed space, a type of research which produces new knowledge for use in present practice in panel heating and cooling.

Odor studies fall into an entirely different category. No clear definition of odor, either physical or physiological, has yet appeared; in this project we are truly going to delve into the unknown about something we all know exists and definitely needs treatment, but which we cannot fully describe with accuracy. Such research represents not only a challenge but also the courageous expenditure of money by the Society. We can be proud of this willingness of our membership to authorize this important search for basic knowledge.

Further efforts have been made throughout the year to cooperate more effectively with other Society committees — Guide, Standards, Program and Papers, and Publication. Information about matters of general interest in connection with Society Research has been made available to our membership, both directly by correspondence and at Chapter meetings both as complete programs and as short reports. The Committee on Research, as individual members and as a Committee working through the Laboratory, has established and is maintaining effective liaison and cooperation with a great number of other laboratories and investigators in our fields of interest in many parts of the world. As reports from abroad come to our Research Laboratory the information they contain is distributed through the Committee and the Technical Advisory Committees.

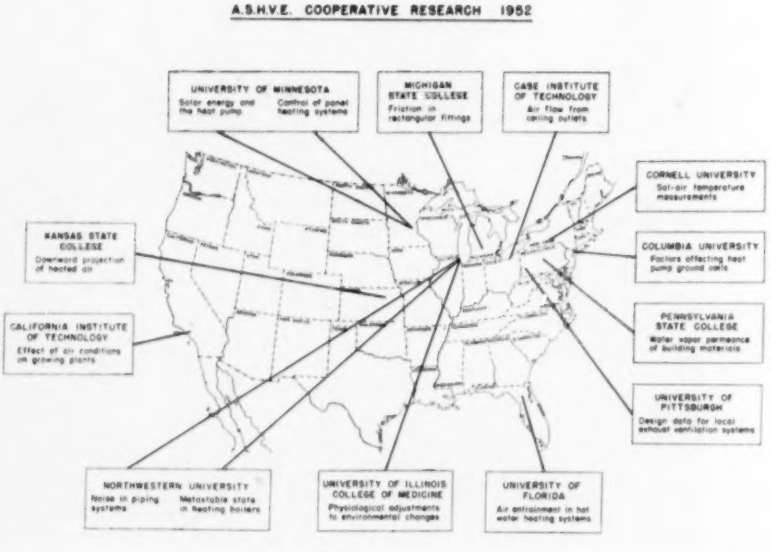

A.S.H.V.E. COOPERATIVE RESEARCH 1952
UNIVERSITY OF MINNESOTA
Solar energy and the heat pump
Control of panel heating systems
MICHIGAN STATE COLLEGE
Friction in rectangular fittings
CASE INSTITUTE OF TECHNOLOGY
Air flow from ceiling outlets
CORNELL UNIVERSITY
Sol-air temperature measurements
KANSAS STATE COLLEGE
Downward projection of heated air
COLUMBIA UNIVERSITY
Factors affecting heat pump ground coils
CALIFORNIA INSTITUTE OF TECHNOLOGY
Effect of air conditions on growing plants
PENNSYLVANIA STATE COLLEGE
Water vapor permeance of building materials
UNIVERSITY OF PITTSBURGH
Design data for local exhaust ventilation systems
NORTHWESTERN UNIVERSITY
Noise in piping systems
Metastable state in heating boilers
UNIVERSITY OF ILLINOIS COLLEGE OF MEDICINE
Physiological adjustments to environmental changes
UNIVERSITY OF FLORIDA
Air entrainment in hot water heating systems

Fig. 1—ASHVE cooperative research—1952

A. SMITH 55-1

Progress reports to the Technical Advisory Committees and to the Committee on Research by the Director of Research have attained a new high in promptness, accuracy and completeness. This year a comprehensive report to the Council carrying the cover title, ASHVE Research — 1952 Accomplishments and 1953 Programs, was submitted in time for study by the members prior to the final meeting of the 1952 Council.

In 1950 a survey was made to determine membership interest in the existing and potential activities open to our research. The Society's long-range research program, as requested by Council, was then prepared on the basis of the results of this survey which had shown a gratifying response from our members. This year another survey has been implemented by direct effective cooperation of the Society's Executive Secretary. A long list of items of present and future potential interest for Society research was sent to the membership along with annual dues statements, with each member requested to indicate his individual suggestions by marking all items of particular interest to him, and with spaces for his written additions and comments. Dues statements are released, and the returns received, over a period of some weeks and the main portion has yet to come in. Once again, however, real membership interest has been indicated. A report of the returns will be published later. Once again this survey will prove a valuable guide to the Committee on Research in its continuous responsibility of keeping the research program, both present and long range, representative of the usefulness desired by the membership which makes it possible.

The close of the present year coincides with the close of a full decade of change and progress in Society research. It was in 1943 that the Society decided to move its research facilities from quarters occupied for many years with the Bureau of Mines at Pittsburgh. Space was rented in Cleveland; the present Director undertook the recruiting, training and assigning of a totally new staff in new quarters. Shortly afterward larger space was acquired outright by the Society for its research and thus another move, this time into commodious and well arranged space, had to be made. During all this period the research program was being carried forward and developed into an expanded program. A relatively short time ago a change in operating methods of the Committee on Research, the Technical Advisory Committees and to some extent the staff, became necessary because of the adoption of the Society's new By-Laws. Comprehensive Operational Guides were carefully written, considered and adopted by the Committee for submission to Council, and by Council authorization were substantially instituted. Concurrently, the directive of Council to extend our cooperative efforts with other institutions, chiefly those having research facilities and interested staffs, was being followed, and important projects set up for cooperative research. Fig. 3 depicts the growth of Society research in the decade 1943 to 1952 inclusive. Fig. 4 shows the growth of ASHVE sponsored cooperative research during the same period.

All of the activities mentioned were superimposed on the daily requirements of an increasingly dynamic research program. Research achievement by the Society, during the decade just completed, has not been permitted to suffer, which makes the record of solid accomplishment truly remarkable. Now that all of this extra work of change and expansion has been completed, Society research faces a period of concentration on the program itself, and can confidently be expected to do the kind

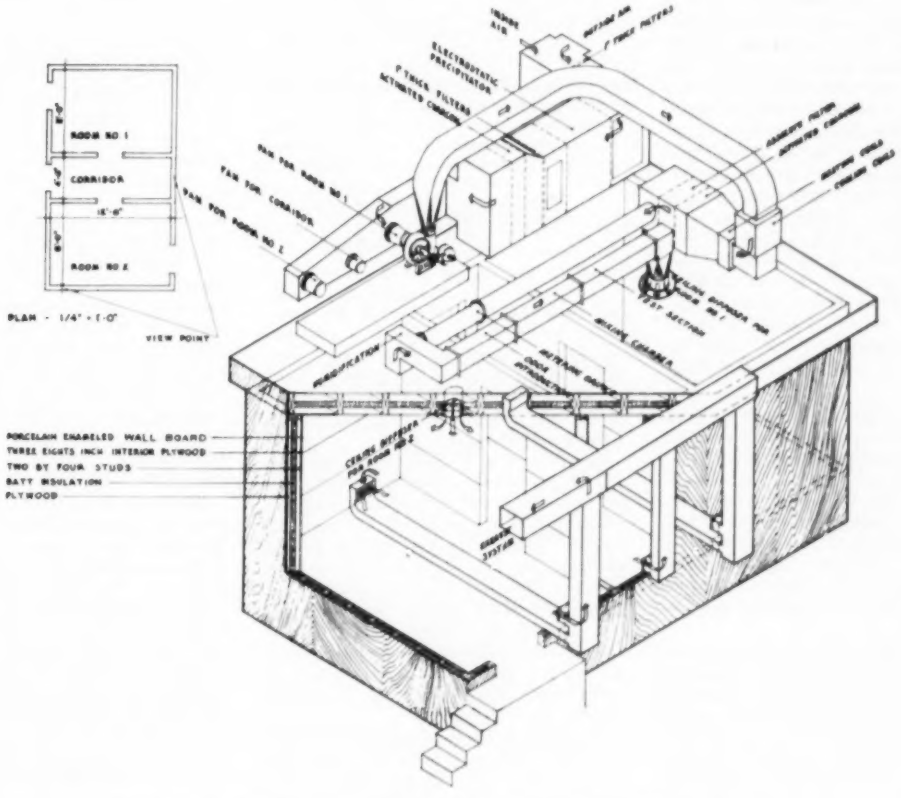


Fig. 2—Isometric view of odor test rooms at ASHVE Research Laboratory

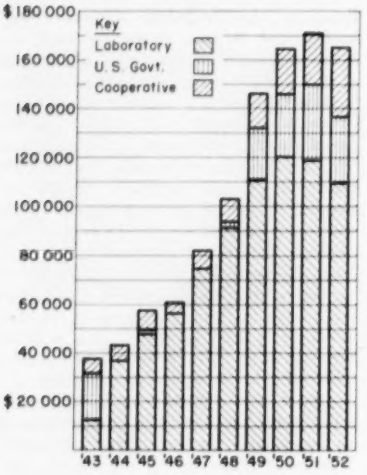


Fig. 3—Research expenditures 1943-1952

of work expected of it by a membership devoted to the advancement of our science and arts. Fig. 5 shows the sources of funds expended on Society research in 1952. Of the $25,000 transferred in 1952 by the Council from the Research Reserve Fund to the Research Operating Fund, $15,640 was expended during the year.

There were some marked increases last year in the number of industrial organizations contributing general funds for Society research, and, as a consequence, an increase in the total amount contributed.

During the Semi-Annual Meeting, certain Society Officers suggested that no matter what benefit the industry might derive from its own developments and activities, the electrical load increases with practically every advance which the industry makes, thus, directly benefitting the electric utility industry. In view of this, it was suggested that an approach be made to this industry to see the extent to which individual organizations in it might be directly interested in support of Society research.

Under the authority of the Ways and Means Committee, and the Committee on Research, the chairman called on a number of electric utilities in the middlewest to discuss Society research and to see whether these organizations felt that they and the Society had a community of interest. These visits were not concerned with direct requests for financial support, but merely to find the grounds, if any, of mutual interest.

During the past few weeks the chairman called on nine such utilities and discussed generally with a group of the top officials of each of these companies, some of the problems of the utilities and what ASHVE research might be able to offer in helping to solve some of the problems connected with the load for which the industry might be considered responsible.

Not in a single instance was he told that there was no community of interest. Some of the companies showed considerable interest and immediately took steps to insure a closer liaison between them and the Society by suggesting that individual members of their staffs apply for Society membership. Two of the companies have already given active support to the research program. It is believed that this example will be followed by others and that the utilities, as a whole, might prove to be very acceptable supporters of Society research in the future. At first, it is more than likely that their contributions would be made through the general

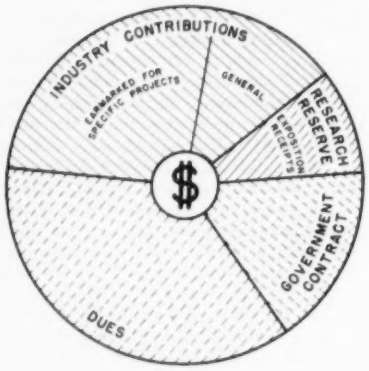


Fig. 5—Sources of funds expended on Society research in 1952

Dues	$59,915
Contributions	
Earmarked	42,972
General	19,273
Government Contract	27,062
Research Reserve	15,642
	$164,864

fund which is administered by the Committee on Research to serve a common interest. It might be, later, that certain phases of the program will prove of more particular interest to the utilities and will merit their more active support by earmarked contributions.

The committee is taking steps whereby officers, past officers, members of the Council and members of the Committee on Research can assist in telling the story of ASHVE research to the utilities in the particular location where they do business or where they live. A special brochure has been prepared to assist in these visits. It may interest the Society membership to know that in the more than 60 cities where the Society has strong representation of membership, there are about 26 million electric meters installed.

The Committee on Research fully realizes what such an expansion of the base of its general contribution means in the way of added responsibilities. The committee now is required to make good

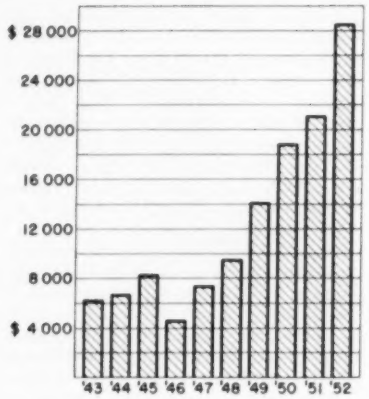


Fig. 4—ASHVE direct grants to cooperating colleges and universities 1943-1952

to our own membership and to those who have supported and made possible the expansion of Society research in recent years. Any broadening of the Society's base of general contributions will increase its responsibility to those who are supporting the research work.

The Committee on Research was much encouraged the other day by a letter received from a member of the official family of this Society. He said that for some time he had felt that as one of those who made a livelihood from the industry, he owed something toward its continued progress. He thought that the best way to meet this self imposed obligation was to support Society research financially because with a sound research program there would be no question about the future industry of which he was a part. His very constructive and helpful letter and the check enclosed with it, were a source of considerable encouragement to the Committee on Research. The example thus shown has been taken up by others and the committee has been told that they intend to see from an examination of their earnings, what contribution they might make to Society research as an individual business investment toward a continuing expansion of our industry.

"With the presentation of this report, my term as Chairman of the Committee on Research comes to an end. May I say that I have enjoyed every minute of these last two years. The Chairmanship of the Committee on Research has become a big job, with tremendous opportunities. I have enjoyed a great measure of cooperation which I appreciate to the full and for which I now wish to express my thanks to all members of a magnificent Society. In saying thank you and goodbye as Chairman of the Committee on Research, I want, if I may, to leave one final thought with the members of this Society; that thought is *I believe in Society Research.*"

Report of the Director of Research

By Cyril Tasker

Following the pattern set in previous years, this portion of the Annual Report of the Committee on Research will attempt to fill in some of the details on the main items in the program. Members and others interested in any particular study are urged to write to the Laboratory for additional information or, better still, to visit the Laboratory and/or cooperating institutions and discuss their interests with those working directly on the projects.

Staff

1952 was a busy year; there were many times when additional graduate engineers could have been used very effectively. We were somewhat disappointed that so few of the June graduates in 1952 seemed interested in ASHVE research fellowships at the Laboratory, for we feel that this is a worth-while plan. Under it we hope to give two or three young engineers two years of post-graduate training in research methods after which they would be available for this rapidly growing industry which, judging by the requests which the Laboratory receives for qualified personnel, can easily absorb each year a number of men with the sort of training that can be had through participation in the Society's research program at the Laboratory and a parallel graduate course at Case Institute of Technology.

Dr. H. B. Nottage resigned from the staff in August to undertake important research and development work in Southern California. His unusually well-developed critical and analytical qualities will be missed at the Laboratory where he contributed much of value to the Laboratory's work in many fields over the past seven years. His outstanding contributions to fundamental research in air distribution have already been recognized, not only by fellow experimentalists and research investigators, but by some of the leading *practical engineers* in the industry. Fortunately, he will be able to continue to assist the Society in some of its research program by serving on Technical Advisory Committees.

The Committee on Research recognized, in September, the fine services which Miss I. M. Jahn has rendered in research operations over the past eight and one-half years by approving her appointment as Administrative Assistant to the Director of Research.

Equipment and Facilities

As in the previous year, 1952 saw important additions made to the Laboratory's

inventory of scientific apparatus and equipment. The Odor Test Rooms, costing about $25,000 to design, build and equip, were the largest single addition in 1952. We are certain that many uses will be found for these facilities even over and above their use in the odor program.

We should look ahead to the time when we can add modern computing apparatus to the Laboratory's inventory. More and more we see the need for this in the solution of complicated heat flow problems, the solution of which by *long-hand* methods becomes impractical. There may also be need for equipment to analyze expeditiously masses of data such as may be obtained in the odor program or from the Environment Laboratory.

Minor improvements were made to the property, which is being maintained in good condition and has long since justified the decision that the Society took in 1946, when it was purchased.

Guide

By making the Chairman of the Committee on Research an ex-officio member of the Guide Committee, liaison is maintained between the two committees. The research man is often apt to think of a research paper as the end point of his work, but, as the present Chairman has pointed out in some of his talks to the Chapters, this is only the beginning for many of the members of the Society, the end point being the translation of the results of research into practical usable information in THE GUIDE.

Members of several Technical Advisory Committees have participated in the revision and rewriting of Guide chapters, and in many cases pertinent chapters have been reviewed by TACs as a whole.

This is a healthy kind of cooperation which could well be expanded. Its present limitations are mostly those of available time: more might be done by adding to the Laboratory staff personnel experienced in the art of technical writing and capable of appreciating both the need for and the methods whereby research results may be translated into practical data. Some steps to this end have already been planned for 1953.

Air Flow and Distribution

Evaluation of Past Work

During the year a sub-committee of the TAC on Air Distribution, with W. A. Grant as Chairman, made a careful study of all work performed under the Committee, both at the Laboratory and the cooperating institutions, in the past decade. The report provides an extremely valuable summary and analysis and contains important recommendations on future Society research in this field.

Isothermal and Chilled Ventilation Jets (ASHVE Laboratory)

The doctorate thesis of H. B. Nottage, covering studies on isothermal jets and on a chilled jet, was submitted to Case Institute of Technology early in 1952. A limited number of copies were distributed to colleges, to the Navy, and to industrial organizations especially interested in basic work on air distribution.

The evaluation sub-committee said *This work is most impressive. We predict that as time passes it will be regarded as one of the Society's great contributions to the advancement of applied science.*

Three papers were presented in June 1952 to summarize certain phases of the work and supplement papers presented in January 1952 and earlier.

Air Velocities in Ventilating Jets (Case Institute of Technology)

Cooperative work continued during 1952. Prof. G. L. Tuve completed a report (presented at the 59th Annual Meeting) on *Air Velocities in Ventilating Jets* in which he reviewed various methods suggested by other investigators for analyzing jet performance and showed that they supported proposed methods for determining velocity patterns along the jet axis, velocity profiles, and the angle of divergence. Experimental data were included for axial and radial annular jets and for air streams flowing along a wall.

Downward Travel of Heated Jets (Kansas State College)

Cooperative work continued during 1952, with assistance from the *Industrial Unit*

Heater Association. Prof. Linn Helander completed a report (presented at the 59th Annual Meeting) on the *Maximum Downward Travel of Heated Air from Standard Long Radius ASME Nozzles.* Graphs and formulas having practical guidance for air conditioning engineers and designers of unit heaters were included. Studies were also made on one commercial type of down-blow unit heater in an attempt to develop suitable conversion factors for the various types of industrial units.

Friction in Rectangular Take-Off Fittings (Michigan State College)

Studies on the resistances of different types of rectangular fittings designed to accomplish divided air streams were under way during 1952. Results given in a progress report show that the resistance of well designed fittings under certain conditions is greater than commonly thought, and that straight-through branch fittings may offer as much resistance as take-off branch fittings under certain conditions. The studies are continuing, to cover a wider range of basic designs.

Heat Flow and Heat Transfer

Cooling Loads

Continuing their studies, made at the suggestion of the TAC on Cooling Loads, Professors C. O. Mackey and N. R. Gay presented, in June, a paper entitled, *Cooling Load From Sunlit Glass,* in which they developed mathematical solutions relating the instantaneous cooling load per square foot of floor to the instantaneous rate of gain of radiant energy. The mathematical results were compared with the performance of a fluid analogue.

The work carried on at the Laboratory under the TAC on Heat Flow Through Glass during 1952 is of particular interest in connection with cooling loads. The two committees have maintained close liaison.

Air Conditioning Thermal Circuit

Believing that trustworthy prediction of the instantaneous thermal load in Btu per hour imposed on air conditioning equipment is an important economic and technical problem, H. B. Nottage prepared, during 1951, a thermal-circuit which was designed to portray and interrelate the major factors which influence the instantaneous equipment load. After careful review and analysis by many interested persons, it was recommended that an exploratory project be undertaken at the Laboratory.

To test the feasibility of this method of approach and to gain additional experience, the equations for a single-room system with northern exposure, one case with glass block walls and the other with ordinary window glass, were set up and solved with the aid of a general-purpose calculating machine (the property of Case Institute of Technology). The results obtained justify the decision to undertake this exploratory project. They show the differences between the cooling load and the instantaneous heat gain calculated by the methods used to date by most air conditioning engineers and given in THE GUIDE. A research paper is being prepared to report the results of this initial study.

Lighting Loads

During the year there was a renewal of discussions with the *Illuminating Engineering Society* on the problem of heat gain due to lighting loads. This question is becoming of increasing interest to air conditioning engineers and to the *IES.*

Shading Studies

The first results of Laboratory studies on the shading of sunlit glass were presented in June in a paper entitled *The Shading of Sunlit Glass: An Analysis of the Effect of Uniformly Spaced Flat Opaque Slats.* The report covered an analytical investigation of the transmission, absorption and reflection of solar radiation by slat-type sun shades such as venetian blinds, jalousies, and some types of sun screens.

During the year the experimental investigation was continued on a number of different slat-type sun shades to supplement the data developed analytically. Transmittance and absorptance of solar radiation were determined; shade color, slat-width, slat-spacing ratio, slat angle, and the position of the sun were the principal factors studied. A second research paper on this work entitled *The Shading of Sunlit Glass: An Experimental Study of Slat-Type Sun Shades* was presented at the 59th Annual Meeting.

In the course of the last six years' work at the Cleveland Research Laboratory a great deal of data on solar radiation were collected. During the year it was possible to make a start on the analysis of these data; this analysis is continuing.

Heat Pump

Moisture Migration in Granular Media

Working under a cooperative contract, Prof. W. A. Hadley and Raymond Eisenstadt of Columbia University completed a study of the transfer of moisture in a granular medium due to a temperature gradient. Using a radioactive salt and special techniques, including a Geiger counter, they were able to show that moisture may move in such a medium either by capillarity or by vapor diffusion. The results indicated that there is a critical moisture content which determines the mode of moisture movement.

Since moisture plays an exceedingly important role in the dissipation or absorption of heat wherever an installation involves hot or cold pipes or cables, buried underground, the results are of significance in the consideration of heat pump ground coils. A paper has been prepared on this work; it is hoped that it will be published in the spring of 1953.

Solar Energy as a Heat Source

Studies which have been under way since early in 1950, under a cooperative research contract with the University of Minnesota, are concerned with systems by which solar energy may be utilized either as a partial or as a total source of heat for operation of heat pump heating systems. Since the availability of solar energy was one of the prime considerations, studies have been completed on the radiation available on horizontal, south-vertical and south-tilted surfaces on cloudless days and the results compared with Weather Bureau records of actual solar and sky radiation.

The relative heating demands for both design conditions and for total yearly heating load are being studied, together with the ratio of design heating load to design cooling load conditions. In the study of solar utilization systems for house heating, a systems chart is being prepared to show all of the possible arrangements by which solar energy might be utilized in a heat pump system. As part of this section a complete analysis is being made of the various types of refrigeration cycles, including their thermodynamic efficiencies.

Components of heat pump systems for utilizing solar energy are being studied, with particular attention to collectors, their types and locations, their efficiencies, both instantaneous and daily, as well as the optimum temperature of collection. Storage systems are being reviewed as to the types of materials, the temperature of storage and the location and types of storage bins.

Heating Loads — Infiltration

Using equipment purchased by the Society and loaned to the National Bureau of Standards, the Heating and Air Conditioning Section of the Bureau made a study of infiltration in one room of the NBS Test Bungalow, using the tracer-gas technique. During this work the Bureau also developed another instrument for measuring the rate of decay of tracer-gas and made comparisons of the results obtained with the two instruments.

Although the results to date are not considered to be wholly conclusive, interesting data were secured on the effect of an open fireplace flue. Tests showed that, under similar outdoor and indoor conditions, the air change rate increased from less than 1 per hr with a closed flue to about 2 per hr with an open flue. With a house volume of less than 5,000 cu ft, about 6,000 cu ft of air was removed through an unheated fireplace each hour.

It is of interest to note that the Advisory Panel on Heating, Ventilating and Air Conditioning of the Building Research Advisory Board included in the recommendations which it made in the BRAB report *A Study of Conservation in Building Con-*

struction the following: — *Urge ASHVE to review existing infiltration data.*

Hot Water and Steam Heating

Noise in Piping

The studies at Northwestern University, being made under a cooperative research contract, were designed to provide information on the generation and transmission of noise in water piping systems as they are related to velocity, water temperature, pressure, pipe size, design configuration and pump vibration, and to discover methods by which noise levels can be reduced. They have been under way throughout 1952.

Quite extensive equipment was set up to control water pressure, temperature and velocity in the piping components under test, which initially consisted of straight runs of pipe with various types and sizes of pipe fittings. Pumps are to be added later.

Since the vibrations (sounds) produced by the piping components could appear either as fluid-borne or as structural-borne vibration, both aspects of the sound transmission were of interest. Provision was made for measuring air-borne sound by the use of a microphone inside a live sound chamber enclosing the test pipe. Vibration pick-ups have been used to detect pipe-wall vibration, and attempts have been made to measure the sound level and frequencies remaining in the water by means of a microphone mounted through the pipe wall into the flowing stream.

Although, as yet, only qualitative information has been obtained, the investigators have concluded: (1) that cavitation is an important factor, (2) that straight runs of pipe do not appear to contribute significantly to the production of noise, at least up to velocities of 10 fps, (3) that noise generated at valves and fittings far exceeds that for straight pipe runs, (4) that while contractions of flow take place quietly, sudden expansions of the flow stream, and also sharp directional changes, produce noise.

Water in its Metastable State in Heating Boilers as a Possible Explosion Hazard

In mid-year the Society entered into a cooperative research contract with Northwestern University to make a study of water in its metastable state in heating boilers as a possible explosion hazard. Water exists in the metastable state when its temperature is above the normal boiling temperature for the pressure existing. Steam could have been generated, but was not. Further heat supply adds energy to the liquid without vapor formation, and the water deviates more and more from normal conditions. A disturbing influence (vibration, surface roughness, etc.) can suddenly cause the water to boil rapidly (with bumping) and give a very rapid increase in volume caused by the sudden flashing. This rapid volume increase could give momentary high pressures which might constitute an explosion hazard.

RESEARCH PAPERS—1952

1. The ASHVE Environment Laboratory, by Cyril Tasker, C. M. Humphreys, G. V. Parmelee, L. F. Schutrum (Cleveland, Ohio) (March 1952, JOURNAL SECTION).

2. A V-Wire Direction Probe, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (Cleveland, Ohio) (April 1952, JOURNAL SECTION).

3. A Low-Inertia Low-Resistance Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum, and G. V. Parmelee (Cleveland, Ohio) (May 1952, JOURNAL SECTION).

4. Outlet Turbulence Intensity as a Factor in Isothermal-Jet Flow, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (Cleveland, Ohio) (May 1952, JOURNAL SECTION).

5. The Shading of Sunlit Glass — An Analysis of the Effect of Uniformly Spaced Flat Opaque Slats, by G. V. Parmelee and W. W. Aubele (Cleveland, Ohio) (June 1952, JOURNAL SECTION).

6. A Smoke-Filament Technique for Experimental Research in Room Air Distribution, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (Cleveland, Ohio) (July 1952, JOURNAL SECTION).

7. Exploration of a Chilled Jet, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (Cleveland, Ohio) (August 1952, JOURNAL SECTION).

8. Heat Exchanges in a Ceiling Panel Heated Room, by L. F. Schutrum, G. V. Parmelee, and C. M. Humphreys (Cleveland, Ohio) (December 1952, JOURNAL SECTION).

9. A Comparison of Physiological Adjustments of Clothed Women and Men to Sudden Changes in Environment, by T. Inouye, F. K. Hick, M.D., R. W. Keeton, M.D., J. Losch, and N. Glickman (Chicago, Ill.) (To be published in the JOURNAL SECTION).

10. Field Studies of Floor Panel Control Systems, by A. B. Algren, E. F. Snyder, Jr. and J. S. Locke (Minneapolis, Minn.) (February 1953, JOURNAL SECTION).

11. Maximum Downward Travel of Heated Jets from Standard Long Radius ASME Nozzles, by Linn Helander, Shee-Mang-Yen, and R. E. Crank (Manhattan, Kan.) (March 1953, JOURNAL SECTION).

12. Air Velocities in Ventilating Jets, by G. L. Tuve (Cleveland, Ohio) (January 1953, JOURNAL SECTION).

13. The Shading of Sunlit Glass — An Experimental Study of Slat-Type Sun Shades, by G. V. Parmelee, W. W. Aubele, and D. J. Vild (Cleveland, Ohio) (January 1953, JOURNAL SECTION).

Air Entrainment in Hot Water Heating Systems

The cooperative research agreement with the University of Florida (Gainesville), to cover the study of the effects of air or gases on the operation of various types of hot water heating systems and methods of eliminating these from the systems, was renewed as of April 1, 1952.

Since results from earlier studies on a simple system were not conclusive, a second system was designed and is being set up with a boiler in the basement and either cast iron radiation or non-ferrous convectors in the basement and on the first or second floors. The piping system has been so designed that by proper valving it may be operated either as a one-pipe system or as a two-pipe reverse return system.

Compression Tank Sizing

Under the sponsorship of the TAC on Hot Water and Steam Heating, H. A. Lockhart and G. F. Carlson of the Bell & Gossett Co. presented a report on compression tank sizing at the 59th Annual Meeting. The work covered in the report was carried out with the purpose of presenting a simple, safe and practical method for sizing compression tanks.

Panel Heating and Cooling

Plaster Panel Tests

When the Laboratory paper on plaster panels was presented in June 1951, questions were raised as to whether or not the test panels were representative of the type and quality of plaster panels encountered in the field. In an attempt to answer this question and provide additional information, two additional plaster panels were constructed at the Laboratory. Both had non-ferrous tubes located 4 in. on center above metal lath with the lath wired to the tubes at 8 in. intervals. Three coat plaster jobs were applied to each panel. On one panel, special care was used to get unusually good tube imbedment, while on the other the tube imbedment is poor and yet probably not unrepresentative of many panels as built in the field. The results obtained with the two panels should indicate differences in performance which might result from variations in plastering. Tests on one panel were completed in 1952; tests on the second panel were under way at the year's end.

Field Tests

Additional field test data, collected in four test houses during the 1950-51 heating season, have been analyzed. In general, the results check those obtained from the previous year's tests, the results of which were published in January 1951.

Concrete Floor Slabs

In 1950 the Laboratory presented a paper on the heat-flow analysis for a con-

crete floor slab having tubes located within the slab and having both surfaces isothermal. Later, a study was made on a second case, in which the tubes are located at the slab-earth interface with the bottom of the tubes tangent to the interface. A practical example of this would be a floor slab laid directly on the earth with pipes at the bottom of the slab.

Although a general mathematical solution was developed to cover this case, most of the application data were developed by means of an electrolytic analogue because of the complexity of the mathematical treatment. A paper covering this work has been recommended for publication.

Heat Exchanges in a Ceiling Panel Heated Room

The Environment Laboratory, put into actual operation in November 1951, was in daily use throughout 1952. Whenever sufficient staff were available, the room was operated on a two-shift per day basis.

The initial work covered an investigation of heat exchanges in a ceiling panel heated room. All of the tests were made with an 8 ft ceiling height, and with the entire ceiling heated. Most of the tests were made with the room empty and unlighted and with all walls and the floor at a uniform temperature. The variables investigated were (a) panel surface temperature, (b) floor and wall surface temperature, (c) infiltration air quantity, and (d) infiltration air temperature. A few tests were made with a non-uniform environment (walls and floor at non-uniform temperatures) and with the room furnished and lighted to obtain some general information on the effects of these factors.

Results from these first series of tests are included in the paper, *Heat Exchanges in a Ceiling Panel Heated Room*, (presented at the 59th Annual Meeting).

Floor Panel

When these tests were completed, another series was started in which heat was introduced through the floor instead of the ceiling. The general scope of the floor panel tests and the variables involved were the same as for the ceiling panel tests. This series was substantially completed by the end of the year.

Control of Panel Heating Systems

Under a Research Fellowship established at the Univesrity of Minnesota (under Prof. A. B. Algren) field studies were made in the 1951-52 heating season in Minneapolis and Milwaukee to develop information on the optimum method of control for each basic type of heating panel installed in various types of structures with varying percentages of glass area.

The 1952 studies were made in (1) a single-story general office building in Milwaukee with a floor panel system (2) the factory area of a plant in Milwaukee, with six zones of floor panel, four in the manufacturing space and two in the office section (3) a residence in Minneapolis, floor area of about 1450 sq ft, with a floor panel heating system consisting of five continuous coil circuits, the residence being divided into four zones.

A paper covering the first year's results was presented at the 59th Annual Meeting.

Physiological Research

The College of Medicine, University of Illinois, working under a cooperative research contract supported jointly by the U. S. Public Health Service and the Society, completed in 1952 the reports of two studies and submitted them for publication. One paper was presented at the 59th Annual Meeting, the other is tentatively scheduled for the Semi-Annual Meeting in 1953.

Physiological Adjustments of Clothed Men and Women

The first paper reports on the physiological changes in healthy young women, clothed in union suits or in summer clothing, on entering a hot moist room and on leaving it. Similar data on young men were reported in January 1952. The experiments were designed to impose stress on the processes concerned in the adjustment of the subjects to heat exposure much as does leaving an air-conditioned space for the outside on a hot humid day and returning to the cooled space with clothing saturated with sweat. The studies showed that there was no significant difference between men and women in their ability to adjust to sudden changes in environment. Since both sexes adjust with equal promptness, the presence of men and women in the same space does not require alterations in accepted specifications for its air conditioning.

Effect of Relative Humidity on Heat Loss of Men Exposed to Different Environments

The second report covers the results of studies on five fasting men, either nude or dressed in union suits, and exposed to environments of different relative humidities and the same dry bulb temperature; it also covers studies on ten young men and eight young women exposed to environments with widely differing humidities.

The results showed that effects attributed to relative humidity appeared more rapidly at higher environmental temperatures.

ONR Contract

Human Calorimetry

The calorimeter which has been designed and constructed at the Laboratory, under a contract with the Office of Naval Research, for the study of heat exchange between the human body and its surroundings, was substantially completed, according to the original design, when the contract period ended on June 30, 1952. At that time the contract was renewed to September 30, 1953 so that additional facilities could be incorporated to permit very accurate control of the air to be used for respiration by the subject during a test.

The equipment required for these additions to the calorimeter is even more complicated and delicate than that developed

ASHVE RESEARCH IN COOPERATING INSTITUTIONS

California Institute of Technology, Pasadena, Calif.: (Research Fellowship) The Role of Air Conditions in Plant Growth, Plant Reproduction and Photosynthesis.
Case Institute of Technology, Cleveland, Ohio: (Research Fellowship) Air Flow from Annular Slots, Ceiling Plaques and Circular Diffusers.
Columbia University, New York, N. Y.: The Investigation of Thermally Actuated Moisture Migration in Granular Media. (Heat Pump)
Cornell University, Ithaca, N. Y.: The Sol-Air Thermometer and the Sol-Air Temperature Concept.
University of Florida, Gainesville, Fla.: Air Entrainment in Hot Water Heating Systems.
University of Illinois, College of Medicine, Chicago, Ill.: The Physiological Adjustments made by Healthy and Physically Impaired Persons to Rapid Changes in Atmospheric Environment.
Kansas State College, Manhattan, Kan.: The Downward Projection of Heated Air Streams.
Michigan State College, East Lansing, Mich.: Friction in Rectangular Branch Take-Off Fittings.
University of Minnesota, Minneapolis, Minn.: (a) Solar Energy as a Potential Heat Source for Heat Pump Installations. (b) (Research Fellowship) — Field Studies on the Control of Panel Heating Systems.
Northwestern University, Evanston, Ill.: (a) Noise in Piping Systems. (b) Metastable State of Water as a Possible Explosion Hazard in Heating Boilers.
The Pennsylvania State College, State College, Pa.: (Research Fellowship) — The Water Vapor Permeance of Building Materials.
University of Pittsburgh, Pittsburgh, Pa.: (Research Fellowship) — Design Requirements of Local Exhaust Ventilation for Control of Atmospheric Contaminants Released by Hot Industrial Processes.

and assembled to date. Though its design, construction and operation presented a number of new problems, good progress had been made by the end of the year in solving most of them and in assembling the equipment.

The originator of the idea behind this calorimeter, Dr. T. H. Benzinger, and his co-worker, Dr. Charlotte Kitzinger, spent several weeks at the Laboratory in November and December making test runs on the calorimeter and on the equipment for the ventilation air circuit. Although, as was expected, the test runs revealed a number of minor points on which further work might be beneficial, the equipment on a whole operated well up to expectations.

Low-Inertia, Low Resistance Heat Flow Meter

A research paper on the construction and use of a special heat flow meter, developed during the ONR contract, was presented at the Semi-Annual Meeting in June. Since that time, the Laboratory has supplied even more detailed information on both the materials and the methods used in the construction of different sizes and types of heat flow meter. A number of organizations have sent representatives to the Laboratory to see how these meters are made and used.

Odors

Special Test Rooms

The construction of the odor test rooms and their various auxiliaries was virtually completed during the 1952 fiscal year. Fig. 2 shows the plan and an isometric view of the rooms. As shown on the plan, the space consists of two 8 ft x 12 ft rooms separated by a 4 ft wide corridor. The ceiling height is 8 ft throughout. All of the interior surfaces of the rooms and corridor are made of a porcelain enameled wall board, selected to provide surfaces which would have low odor absorption and could be easily cleaned.

A separate air conditioning system was provided for each of the test rooms and the corridor, thereby making it possible to independently control the temperature and humidity in each space. The conditioning equipment, consisting of heating and cooling coils, air cleaning equipment, fans, and ducts, is located above the rooms. The isometric drawing shows the system for room No. 1; the system for room No. 2 is identical. In addition to controlling the temperature, humidity, and cleanliness of the air entering the rooms, these systems provide for the measurement of air flow, and for the introduction of odors into the air streams. The system for the corridor is identical with those for the rooms, except that in the corridor flow measurement and odor introduction are not required.

Equipment for heating or cooling and circulating the liquid to the coils was located on the ground floor of the Laboratory, approximately under the rooms. A cast iron boiler was installed in the main boiler room to provide steam for water heating and humidification.

Program

An odor test program has been drawn up after consultation with TAC members and others. Since the first step will be the training of an odor panel, members of which will be selected from the present Laboratory staff, visits were paid, during December, to other laboratories which have specialized in odor work, to discuss problems of panel training and testing techniques with the men in charge. The suggestions and assistance obtained will prove most helpful in getting the Society's program under way.

The project will also require the development of a number of new techniques, such as the introduction of measurable and reproducible odor concentrations into the air stream. The first actual testing is being planned to try to develop information regarding the effect of temperature and relative humidity on odor perception. This will be done by determining the relative rates of odor introduction necessary to produce odors of recognition-threshold-level in the rooms at different temperatures and humidities.

Plant and Animal Husbandry

In mid-year, the Chairman, A. J. Hess, completed his organization of the Committee which has six engineering members and seven members eminent in the fields of plant physiology, botany, dairy husbandry, animal nutrition and biology. As part of its activities, this Committee, which is quite unique among Society TACs, will endeavor to translate the results from past and current research in plant physiology and animal husbandry into information useful both to those who desire to have optimal environmental conditions for animals and for growing plants, and for the engineer who is called upon to design systems to maintain such optimal conditions.

Role of Air Conditions in Plant Growth

Studies have been under way during 1952 at the Earhart Plant Research Laboratory of the California Institute of Technology, Pasadena, under a cooperative research agreement with the Society. The basic purpose of this work was to study the role of air conditions in plant growth, plant reproduction and photosynthesis, the particular objective being the establishment of the optimal greenhouse conditions for the growing and fruiting of tomatoes. It was hoped that from these studies data would be secured that would make it possible to write proper specifications for the construction and equipping of greenhouses.

Tests made to determine the variation in optimal growing and fruiting conditions for different varieties of tomatoes yielded very interesting results, which have clearly indicated some of the possibilities that exist for air conditioning of tomato greenhouses. They have also made it possible to specify the proper temperature control of the greenhouse in relation to the light intensity during the day. Experiments made to determine the effect of the rate of air movement past the plants showed that the best plants were produced when the rates were relatively high (100 to 200 fpm).

The experimental program as originally defined was substantially completed by the end of the year and a complete report was in preparation.

Air Cleaning

Filter Test Methods

The joint efforts of the Laboratory and the members of the Technical Advisory Committee resulted in the development late in 1951 of the third draft of proposed testing procedures for rating air cleaning devices used in general ventilation. In mid-year, this draft, with detailed drawings included, was distributed for further study.

Shortly afterward the Society was advised that the *Air Filter Institute*, which is composed of twelve manufacturers of air cleaning devices, planned to develop proposed test methods for mechanical-type filters and that Society cooperation would be welcomed.

In mid-November the *AFI* made available the results of the first series of tests with the proposed test method, which is a gravimetric method using an *absolute filter* to catch all the dust that passes the test filter. The *AFI* later submitted the proposed method to the TAC for comment, advising that other sections were in preparation covering test methods for electrostatic filters, and for automatic mechanical filters.

Test Dusts

General agreement is still lacking on the question of the most suitable test dust or dusts for use in filter testing, the question on which previous efforts to secure a suitable code have foundered. The *AFI* proposed code uses fine Arizona road dust, carbon, and lint. Although efforts by the Laboratory staff early in 1952 to secure sized fractions of spherical glass beads for possible use as a test dust met with very limited success, these efforts are being continued with the cooperation of certain industrial organizations.

The Industrial Environment

During the year the TAC was reorganized into 6 groups covering respectively the following fields: Supply Air Conditioning; Process Aerodynamics; Air Contaminants; Temperature Extremes; Exhaust Air Cleaning (Air Pollution Control); Industrial Exhaust Systems.

Design of Local Exhaust Ventilation for Hot Industrial Processes

Under a cooperative research contract with the Society, the Graduate School of Public Health, University of Pittsburgh, has been making a study of the basic principles of local exhaust ventilation for hot industrial processes. The ultimate purpose of this study is to determine the exhaust ventilating rate required to capture contaminated air rising from hot processes so that design data can be developed.

Experimental *hot bodies*, capable of giving surface temperatures of from 650 F to 900 F, were constructed at the University and an investigation made of various means for determining the surface temperature of the hot body, and the temperatures and velocities of the convection air currents around the body. In measuring air velocities, use is being made of certain techniques developed during Society sponsored research on the downward blow of heated air streams, under way at Kansas State College.

The results of preliminary studies on the nature and direction of convection flow over a hot body seem to indicate that exhaust hoods located not too far above hot operations need not cover the entire hot surface but could be reduced to one-half or three-quarters of the diameter of the hot body, depending on the surface temperature. There would be an advantage in this in certain industrial operations where larger hoods interfere with the operation of the process. The studies are continuing.

Spot Cooling

The group covering *Temperature Extremes* has been making a study of available information on spot cooling, by a review of pertinent literature, inquiries about installations at various industrial locations, and inquiries regarding the use and physiological aspects of spot cooling. From an analysis of the information gathered to date it is suggested that though spot cooling is far more widely used than originally believed, it is often misunderstood and frequently misapplied. Design information and application data are meager and information is greatly needed as to the conditions resulting from undesirable drafts. Experimental work has been suggested.

Insulation

Thermal Properties of Building and Insulating Materials

The TAC continued, during the year, to study available data on insulating materials and building constructions and recommended changes and additions to the data published in THE GUIDE.

After a two-day meeting in April the Committee submitted a proposal covering the complete review and analysis of all available data, to be made by a full time member of the Laboratory staff. This proposal was approved by the Committee on Research in June, and on October 1, M. L. Erickson, a graduate of the University of Minnesota and a member of the staff of its Engineering Experiment Station, joined the Laboratory staff to undertake this study.

The objectives of the long-range program are (1) to revise and improve Guide data, (2) to develop improved methods for presenting such data, and (3) to study the effect of factors affecting heat flow through building and insulating materials.

As an initial step in compiling the desired information, technical data on materials that are used today as building materials, insulation, vapor barriers, etc., were requested in a personal letter sent to about 400 organizations. The response to this has been encouraging.

Measurement of Moisture Permeation

Under a cooperative research contract with the Society, Prof. F. A. Joy and A. W. Sherdon of The Pennsylvania State College made a study of rapid methods for the measurement of water vapor permeance of thin materials of the type often used as vapor barriers. The studies resulted in the development of a new instrument, an *Orifice Type Permeometer*, on which a patent disclosure has been filed. A paper covering the development and use of the instrument, submitted in October, will probably be published in 1953.

Sorption

Methods for Testing Sorption Type Dehumidifiers

The TAC continued its efforts to develop a tentative code covering laboratory methods of procedure for determining the performance characteristics of sorption type dehumidification equipment. A draft of a code was developed in the spring and was under study by the TAC members, preparatory to its submission through the Committee on Research to the Standards Committee.

Dynamic Characteristics of a Solid Adsorbent

The TAC favorably recommended to the Committee on Research a proposal submitted by The Pennsylvania State College, the purpose of which was to determine the characteristics, both adsorptive and desorptive, of a solid desiccant (silica gel) under dynamic air conditions. The project was approved by the Committee on Research for activation in 1953.

Sound and Vibration Control

The scope of the Committee's activities was extended in mid-year to include the evaluation of all factors involved in the measurement and control of sound and vibration in heating, ventilating and air conditioning systems and equipment.

Following discussions on some of the major problems still facing the industry, the Committee recommended that studies be made and specifications developed for the measurement of noise characteristics of centrifugal and axial fans coupled to a duct system.

There is general agreement that a research program in sound and vibration control should be divided into three broad categories to cover (1) problems of interest to the manufacturers of equipment (2) the development of data likely to be of value to design engineers (3) studies primarily concerned with the standpoint of the user of equipment and organized to determine what the user might want and how best to secure it. Unfortunately, measurement techniques are, as yet, not well established and present performance standards appear to be inadequate.

Combustion

Pulsation in Oil Flames

In presenting its long range program to the Committee on Research, the TAC on combustion indicated that problems associated with pulsations in oil flames were of major importance and merited a high priority in future research under the Committee. Resonance in gas flames was recognized as a somewhat parallel problem; in fact it was felt that the two problems were basically the same but that the oil problem was, at that time, more acute.

During the year the Chairman and other Committee members visited a number of colleges and institutions at which work has been done on oil flames or which had staff interested in the possibility of research on this subject. Although no definite plans had been formulated by the year end, much useful information had been collected and the likelihood of being able to develop a project became a distinct possibility.

See April issue for PROCEEDINGS

of last three sessions

of

59th ANNUAL MEETING

Oregon Chapter 8th State Air Conditioning Conference to be Held March 18-20

THE OREGON Chapter of ASHVE is again sponsoring an Air Conditioning Conference. Held in conjunction with the 1953 Northwest Heating and Air Conditioning Exposition, the Conference promises to be the largest and most beneficial to both those engaged in heating, ventilating, and air conditioning and the public which has ever been held in the Pacific Northwest.

The setting for this event will be the New Lincoln High School Building in Portland, Ore. This 8th Oregon State Air Conditioning Conference will be held March 18, 19 and 20. The Exposition will be open for the convenience of the general public during the afternoon and evening of March 21.

These Oregon Chapter Conferences are unique in many respects. The Exposition remains closed during all technical sessions. A reasonable portion of the Conference and Exposition time is arranged for the general public with no admission fee charged. Radio publicity and newspaper space are purchased, advising the general public, and inviting their attendance.

This program is based on the fact that consulting engineers and architects will design as good a heating, ventilating, air conditioning system, or structure as requested by the client.

The Conference and Exposition will be similar to that held in Portland in 1948, at which 371 from eight states were registered at the technical sessions, over 1,500 townspeople attended each of the two sessions for the public, and, it is estimated, more than 5,000 persons saw the exhibits. There is every indication that the Conference and Exposition this year will be even larger.

The program for the technical sessions includes subjects as follows: *The Newer Concepts of Forced-Air, Warm-Air Heating Systems; Things to Know About Blowers; Design of High Pressure Air Systems; Low Cost Piping; Developments and Practice of Steam Heating; Design of High Temperature Hot Water Heating Systems; Chimneys in Theory and Practice; Practical Means of Abating Air Pollution and Combustion; and Combustion Chamber Design.*

In addition, two subjects are planned for presentation in sessions for the public on successive evenings on *How Shall I Heat My House?* and *Air Conditioning In Portland? Why?*

This is a public relations overture found effective in 1948 and arranged again to fulfill the Chapter's obligation toward being a benefit to the public.

Most of the speakers are nationally known authorities on their subjects.

Held in conjunction with the Conference, the Northwest Heating and

The Air Conditioning Conference sponsored by the Oregon Chapter of ASHVE will be held in conjunction with the 1953 Northwest Heating and Air Conditioning Exposition. (View of New Lincoln High School, site of the Conference.)

Air Conditioning Exposition, headed by W. R. Pindell, will be in the same building. Fifty large booths are available and have already been contracted for, and over 200 items of equipment will be demonstrated. National, as well as local, firms will be represented. All equipment displayed will be restricted to this industry.

The Annual Meeting of the Chapter and the Conference Banquet, Oregon style and never dull, emceed by J. P. McDermott, will be Friday evening, March 20.

The Oregon Chapter Committee in charge of the 8th Oregon State Air Conditioning Conference is: E. R. Lokey, *General Chairman;* J. D. Kroeker, *Technical Program;* C. W. Brissenden, *Finance;* W. D. Gutzler, *Publicity;* A. W. Freeman, *Arrangements;* Helen L. Woolley, *Registration;* R. S. Freidenrich, *Banquet.*

*Summary of Chapter Meetings**

• *ARKANSAS:* The January meeting was called to order at the Albert Pike Hotel by Pres. E. N. Pettit, Jr. Directly following this, the new officers took over their respective offices for the coming year. J. L. Coplin, in his auditing committee report, stated that chapter checks would be printed with the word *Treasurer* imprinted thereon instead of the individual's name. The membership approved of the motion that future meetings be held at the Sam Peck Hotel. After some discussion a budget committee was formed to provide a program for finances. J. C. Lewis and Morris Benkovitz will assist J. L. Brown in this matter.

The newly elected president, Herman Cumnock, introduced the guest speaker, A. H. Beasley, Wagner Electric Co., St. Louis. Mr. Beasley gave a comprehensive talk on the different motor frames and electrical types of motors. A question and answer period followed his discussion. Attendance 34. Attendance ratio 0.40.

• *BALTIMORE:* The January meeting was a joint meeting with the Washington, D.C. Chapter and the Baltimore-Washington Section of *ASRE*, which was held at the Engineer's Club of Baltimore.

G. B. Johnson, Newport News Shipbuilding and Dry Dock Co., spoke on air conditioning and ventilation in ship work. He enumerated some of the problems encountered in the design and installation of duct work and the air cycle in general and included the following items: fan pressures, speeds, noise and vibration, vapor seals, duct velocities and location and baffling of air supply diffusers. A lively question and answer period followed Mr. Johnson's discussion. Attendance 125.

• *CENTRAL NEW YORK:* Lawrence Macrow introduced the guest speaker, Noble Hurst, Carrier Corp., whose subject was *Industrial Heating.* Mr. Hurst discussed the present day methods of heating industrial buildings and factories having large areas, high ceilings and large cubical contents. He gave factual data on temperature gradients resulting from projection heating in contrast with floor mounted equipment for heating. He also gave information on relative fuel consumption when using various kinds of industrial heating systems including projection heating. A question and answer period followed Mr. Hurst's talk.

Pres. F. E. Krell called the January meeting to order at the University Club, after which A. L. Jones presented the Past President's pin to J. H. Carpenter. Attendance 53. Attendance ratio 0.28.

• *CENTRAL NEW YORK:* C. R. Acheson introduced the guest speaker, O. M. Mader, chief of the Architectural Section, Aluminum Co. of America. Against a background of excellent color slides, Mr. Mader spoke on *Climate Control in the Lightest Building Ever Built.* Mr. Mader's talk dealt with the general background and innovations incorporated in the new Alcoa Office Building in Pittsburgh, Pa.

Pres. F. E. Krell called the November meeting to order at the Bellevue Country Club. Attendance 52. Attendance ratio 0.25.

• *CENTRAL OHIO:* J. A. Eibling, research engineer, *Battelle Memorial Institute*, Columbus, speaker of the evening, chose as his topic the development and design data of heat pump systems. Mr. Eibling illustrated his discussion with slides. Pres. A. D. Bogen called the January meeting to order at the Fort Hayes Hotel. Attendance 35. Attendance ratio 0.40.

• *EMPIRE STATE CAPITAL:* At the December meeting, held in Panetta's Restaurant, Pres. Harry Horowitz was appointed to serve on the Chapters Conference Committee for one year from the opening day of the Annual Meeting. N. W. Burrill was appointed as alternate member.

H. F. Kruger introduced the guest speaker, Charles Sperlik, metallurgist, Revere Copper and Brass, Inc., Rome, N. Y. Mr. Sperlik showed films on the fabrication of copper and brass alloys. An informal discussion period followed the showing of the film. Attendance 32.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

• *MANITOBA:* W. J. Atkinson introduced the visitors at the November meeting. A. K. Piercy was appointed the Chapter's representative on the Chapters Conference Committee with G. E. Randall as alternate member.

Mr. Piercy introduced the guest speaker of the evening, K. E. Robinson, who spoke on *Demonstration of the Principles of Exhaust Ventilation*. Mr. Robinson used numerous slides and models to illustrate his discussion. A brisk question and answer period followed the talk.

Pres. W. J. Atkinson called the meeting to order at the Fort Garry Hotel. Attendance 29. Attendance ratio 0.40.

• *MASSACHUSETTS:* G. T. Roberts, Jr., R. R. Forbes and R. E. Pettit were elected members at the November meeting.

A. L. Hare introduced the coffee speaker, Riley Hampton who chose as his topic *The Engineer and His Community*, which covered the engineer's training and qualifications for jobs in the local community.

The subject of the principal speaker, A. W. Gifford, counselor, Associated General Contractors, was *How To Stay in Business and Out of Court*. Mr. Gifford presented an outline, *know, check, perform, complete, collect*, and then proceeded to discuss each item fully. He emphasized the desirability of all parties concerned making the utmost attempt to settle their differences without litigation. A lively question and answer period followed the talk. Attendance 65. Attendance ratio 0.20.

• *MIAMI VALLEY:* At the December meeting, held at Sutmiller's, R. J. Perkins, by-laws committee chairman, reported that the by-laws would be reviewed and presented at the next meeting for discussion.

Harold Wright, city inspector, reported on plans for revision of the heating code. He said the code should be acceptable to the following three groups: (1) mechanic, (2) engineer, and (3) manufacturer. J. M. Schweiger moved that a committee of no less than three members be appointed to analyze the code procedures of the city and that reports be made to the members. Pres. D. L. Bergman appointed Charles Dondigan, chairman, with Mr. Schweiger and E. T. Simonson to serve as members.

President Bergman, in his President's Report, praised the hard working group at the Environment Laboratory, adding that ASHVE comfort standards have been generally accepted throughout the country. He also commended the Research Laboratory in Cleveland for its outstanding results.

The program was a discussion on three types of boilers: (1) fire tube, (2) water tube, and (3) package and generator type boilers. President Bergman discussed the fire tube; G. G. Schultz, the water tube boiler; while J. B. Rishel spoke on the generator type boiler. A discussion period followed. Attendance 25. Attendance ratio 0.24.

• *MONTREAL:* Henri Dagenais introduced the guest speaker, Max Ford, who stated *There are many things in Canada which require ventilation*, and in this humorous manner he continued his talk.

Pres. W. G. Hole called the December meeting to order at the Aviation Building after which J. L. Knight announced the plans for the Chicago trip to the 59th Annual Meeting in January. Attendance 79. Attendance ratio 0.50.

• *NEW YORK:* Pres. P. B. Gordon called the January meeting to order at the Building Trades Club, and introduced a new chapter member, R. J. Tesar.

Vice Pres. J. E. Schechter introduced the guest speaker, R. L. Williams, manager, Refrigerant Sales, Kinetic Chemicals Div., DuPont Co. Mr. Williams' topic was *Refrigerants and Their Application to the Air Conditioning Industry*. He described the search for refrigerants which would have suitable thermodynamic properties and be stable and safe. He compared "Freon 22" with "Freon 12", ammonia, carbon-dioxide and methyl chloride. There were 208 fluorinated compounds examined, and of these five were selected for widest use: "Freon 11, 12, 22, 113 and 114".

Mr. Williams stated that the type of refrigerant should not be changed in a system without a careful consideration of all the materials and equipment, as different refrigerants operated at different temperatures and pressures and required different pumping capacities. Refrigerants also had different effects on gaskets and seals. He also stated that at present about 89 percent of the farm freezers now were operating on "Freon 22", which increased capacity about 60 percent for the same compression displacement used for "Freon 12."

Mr. Gordon presented Life Membership Certificates to M. S. Smith and E. O. Marty. Mr. Smith also became a Life Member of the Chapter. Attendance 80. Attendance ratio 0.20.

• *NORTHEASTERN OKLAHOMA:* The following were elected to serve for 1953: *President*—J. N. Watt; *Vice President*—V. W. Miles; *Secretary*—J. C. Netherton, Jr.; *Treasurer*—H. H. Hubbell; *Board of Governors:* T. W. Allen, C. H. Dollmeyer and R. W. Winget.

President Dollmeyer introduced the guest speaker, I. W. Cotton, president, The I. W. Cotton Co., Indianapolis, and Chairman of the Committee on Research, who spoke on the subject of *The Significance of Society Research*. He briefly discussed each of the research projects being conducted by the Society. By use of slides, he showed the facilities and instrumentation at the Society's Research Laboratory in Cleveland.

The December meeting was held at the University of Tulsa Student Activities Building. Attendance 25. Attendance ratio 0.50.

• *NORTHERN OHIO:* At the December meeting Treasurer J. R. Venning reported that the cash balance for the Chapter as of that date

was $1,038. Pres. R. E. Sherman asked for, and received unanimous acceptance of the new by-laws.

After the business meeting, master of ceremonies J. E. Wilhelm introduced the panel of five Chapter members who would speak. They were: John Paul Jones, who spoke on common errors in duct design; D. L. Taze, whose topic was fan installations; H. E. Wetzell talked about steam heating installations; W. W. Lige spoke on hot water systems and H. R. Canoyer chose controls as his subject. All of the speakers presented a brief resume of the engineering errors that were prevalent in their field of interest and experience. It appeared that the errors arose as a result of insufficient knowledge or misunderstanding of the available information or inattention on the part of the designer, and insufficient attention and inspection paid to the job as it is installed. Following the speakers' presentations, each subject was covered by questions from the members.

The meeting was held at the Chester Room of the Allerton Hotel. Attendance 74. Attendance ratio 0.30.

• *ONTARIO:* After Pres. J. H. Ross opened the January meeting, held at the Royal York Hotel, John Coates introduced the guests.

There were three speakers for this meeting: A. J. G. Campbell, Imperial Oil Ltd., spoke on *How to Burn Bunker C Oil;* Arthur Nearingburg, Sheldons Engineering Ltd., chose as his topic, *The Place of Induced Draft Fans vs. Gravity Stacks in Small Buildings;* while R. S. Mathison, Trane Co. of Canada, discussed, *Is the Cost of Air Conditioning Justified in Modern Office Buildings.* A discussion period followed each speaker's address. Attendance 120. Attendance ratio 0.23.

• *OREGON:* Vice Pres. A. N. Hoss introduced past president, E. R. Lokey, who gave a unique introduction to A. J. Hess, the principal speaker. Mr. Hess, president, Hess-Greiner & Polland, Los Angeles, gave the Chapter a complete resume of the Society's research program.

R. L. Schroeder opened the subject of student papers at this meeting. After a brief discussion, J. P. McDermott moved that the Chapter go on record as approving presentation of student papers and that a committee be appointed to cover the necessary details. It was also decided that the papers be presented at the May meeting.

Pres. K. H. Hanson called the January meeting to order, after which various committees made their reports. Attendance 64. Attendance ratio 0.40.

• *OTTAWA VALLEY:* This meeting took the form of a social get-together at the Prescott Hotel. Following dinner, a brief meeting was held. D. E. Banton made the motion that the by-laws be adopted. This was carried unanimously.

Pres. Bernard Stotesbury called the meeting to order and introduced the guests present. Attendance 41.

• *PITTSBURGH:* Prior to the main feature of the evening, G. M. Comstock spoke about the state registration of the Society of Professional Engineers.

C. H. Schneider, who acted as narrator for the panel, gave a history of each of the following speakers for the evening: T. F. Rockwell, W. P. Chapman and J. L. Coleman, Jr., all members of the chapter.

Mr. Rockwell, the first speaker, discussed panel heating in general, taking into consideration the size and shape of the room, material, light sources and room air. He had slides showing the conditions of different rooms and how the heat loss was figured. It was Mr. Rockwell's opinion that ceiling panels are better than floor panels for the different types of rooms he discussed.

Mr. Chapman chose as his topic *Snow Melting Panels.* He told what the research and different companies were doing to find the answers to the problems involved. He showed slides which illustrated the proper way to install a snow melting panel in the sidewalk.

The last speaker, Mr. Coleman, spoke from the standpoint of the contractor. He showed slides of some installations performed by his firm and he also spoke of the methods of welding and installing different kinds of panels.

As a group, the panel covered the matter from an engineering point of view to the manufacturer's coming finally to the heating contractor, who showed the results of their work. A lively question and answer period followed.

Pres. B. B. Reilly called the January meeting to order at the Webster Hall. Attendance 80. Attendance ratio 0.30.

• *ROCKY MOUNTAIN:* At the December meeting Fred Janssen and B. H. Spurlock, Jr., were appointed as Chapters Conference Committee member and alternate member, respectively, for the Annual Meeting in Chicago.

H. L. Wray introduced the guest speaker, Harold Marshall, Marshall & Johnson, who gave a short talk on current design of mechanical equipment and its application in the current building designs. Mr. Marshall particularly stressed school designs. The talk was followed by an interesting discussion period. Attendance 47. Attendance ratio 0.50.

• *SACRAMENTO VALLEY:* At the January meeting D. R. Blanchard reported that the Chapter had received 13 applications for membership. R. A. Sarro announced that the treasury had a balance of $111.00, and asked that members pay their dues as soon as possible. J. E. Day reported for the attendance committee.

E. C. McKinsey, program chairman, introduced the guest speaker, Herbert Lemkau, product application engineer, Crane Co., San Francisco. Mr. Lemkau, who has been in the heating department for 30 years, chose as his topic *Hot Water Base Board Heating and Forced Warm-Air Perimeter Heating.* He also gave

comparative cost figures on steel *vs.* copper tubing for radiant panel installations. The talk was made more interesting because of frequent references to installations the speaker had personally worked on. A lively question and answer period followed the talk.

Pres. L. A. O'Meara called the meeting to order at the Coral Reef. Attendance 53. Attendance ratio 0.60.

• *ST. LOUIS:* J. C. Watkins reported that application for membership had been received from Joe Fillo, General Controls Co. E. T. Clucas, although absent, sent in his treasurer's report which showed a balance of $813.94 on hand.

H. C. Sharp, Jr., introduced the guest speaker, Vance C. Lischer, Horner & Shifrim Co. Mr. Lischer's topic was *Experiences in Pakistan*, which he illustrated with colored slides and movies. After the discussion, the members viewed a display of the articles which Mr. Lischer had brought back from Pakistan.

Pres. C. H. Burnap called the meeting to order at the Congress Hotel. Attendance 51. Attendance ratio 0.40.

• *SHREVEPORT:* At the January meeting, Pres. W. S. Evans appointed the following committees: *Publicity*—J. E. Reed, J. B. Struwe; *Greeting*—Osborne Dykes, Jr., J. L. Collins, Jr.; *Technical*—J. C. Cox, R. M. Hood; *Program*—W. E. Fitzgerald; *Speakers*—D. F. Coburn; *Attendance*—H. L. Meyer, C. M. Hadra, A. H. Otto; and *Membership*—J. W. Cherry and Art Dickson.

Vice Pres. M. A. Hudson introduced the guest speaker, W. J. Killian, Eastern district representative, Herman Nelson Division of American Air Filter Co. Mr. Killian showed the film *Design for Learning*, which was preceded by a brief introduction. He then talked on the experiments being conducted at the Laboratory School in Moline, which he illustrated with slides. The talk was followed by a question and answer period. Attendance 37. Attendance ratio 0.50.

• *SOUTHERN PIEDMONT:* L. F. Lawrence Jr., membership chairman, reported that the drive for membership had succeeded in bringing thirty new members to the chapter, with two applicants still before the Society for acceptance.

The January meeting, held at Thacker's Restaurant, was called to order by Pres. R. M. Warren. After several committees made their reports, the motion was made and passed that the Chapters Conference Committee representative invite the new Society President to the Chapter's June meeting to be held at Roaring Gap, while at the 59th Annual Meeting in Chicago.

• *SOUTHWEST TEXAS:* Pres. D. E. Locher reported the following committee chairmen had been appointed for 1953: *Program*—L. H. Hornor; *Membership*—H. J. Faller; *Chapter Relations*—L. S. Pawkett; *Legislative*—F. B. Frazee; *Public Relations*—W. J. Brinkmann; *Finance*—F. B. Frazee; and *Social*—R. W. Kotzebue. He also announced that L. H. Hornor and W. E. Long had been appointed member and alternate member, respectively, on the Chapters Conference Committee.

W. E. Long brought up the proposed chapter scholarship fund, and after discussion it was established that the fund be in the form of aid available to students attending schools in which ASHVE Student Branches were established; also that the scholarship fund committee report their recommendations at the March meeting.

J. L. Rea, Jr., introduced the guest speaker, Dr. D. B. Harmon whose topic was *Responses to Environment*. Dr. Harmon's talk was a projection of his research and experimentation on *The Coordinated Classroom*, extended to cover the field of response to controlled temperature and humidity. School children of 6 to 18 years investigated, indicated that they had the same calorific intake as an adult. As the child has less body surface to radiate this heat, a greater amount is expended in energy if thermal environment is held at adult comfort levels. Dr. Harmon's research indicates that temperatures — and he prefers the term *efficiency temperature* to *comfort temperature* — for students be held approximately 3 degrees below the standard effective temperature design condition.

The study of school age children has led to studies of pre-school children where temperature control, again influenced by the great amount of food consumption, is even more important in nurseries, etc. These studies are being projected into industrial fields to determine efficiency effective temperature for a wide range of activity and projected for hospitals as a stimulus for patient recovery. A discussion period followed Dr. Harmon's talk.

President Locher called the January meeting to order at the Manor Tea Room, after which he presented Mr. Long with the Past President's pin. Attendance 23. Attendance ratio 0.20.

• *UTAH:* G. L. Soderborg, program chairman, introduced the guest speaker, M. J. Bertosch, attorney, Union Pacific Railway Co. of Salt Lake City. Mr. Bertosch spoke on industrial law with regard to various trades in connection with suits caused by negligence on the part of the contractor, owner and visitors. He discussed the various angles of neglect and responsibility as viewed by the law.

The January meeting which was held at the Doll House was called to order by W. R. Wilde. Alfred Richeda, secretary, announced that dues were payable. Attendance 18.

• *WASHINGTON, D. C.:* The January meeting was a joint meeting of the Washington, D. C. and Baltimore Chapters of ASHVE, and the Baltimore-Washington Section of *ASRE*. E. R. Kent, president of the Baltimore Chapter introduced the guest speaker, G. B. Johnson, New-

port News Shipbuilding & Dry Dock Co., Newport News, Va.

The members had expected Mr. Johnson to speak on air conditioning, heating and ventilating and refrigeration on the superliner, The United States, but he explained that such information was considered secret and that he would confine his talk to *a large passenger vessel built in Newport News.* He then proceeded to talk on data which he illustrated on the blackboard. He outlined the problems encountered in keeping down air velocities in staterooms, the determination of comfortable entrance temperatures, etc. Mr. Johnson then told the audience that the ducts they designed were for velocities of 3500 to 4000 fpm, but that air movement in living spaces finally was established at about 50 fpm, with entrance temperatures in summer of 60 F. These ducts are of aluminum, with about 1 in. of insulation and with airlocks of aluminum foil. Mr. Johnson further explained that the vibration of rather high speed axial flow fans was quite a problem, but that after trial and error they solved it.

The meeting was held at the Engineers Club. Attendance 29. Attendance ratio 0.20.

• *WASHINGTON, D. C.*: J. C. Benson introduced the guest speaker, J. W. Landis, Industrial Power Branch, Division of Reactor Development, Atomic Energy Commission. Mr. Landis stressed the fact that we should harness our atomic power to help conserve our known natural fuels. At the present rate of consumption, conventional fuel reserves would last 654 years. However, Mr. Landis stated, our rate is increasing rapidly and it would be conservative to estimate exhaustion within 100 years. He further stated that the cost of nuclear fuels is only about 1/40 of that of conventional fuels now used in large central stations, based on breeder reactor consuming the uranium completely. Therefore, the enormous increase in the required investment in a nuclear power plant appears to be well justified. To illustrate his talk, Mr. Landis showed slides of experimental reactors now in use or being built. A lengthy question and answer period followed the discussion.

Pres. G. R. Walz called the December meeting to order. On the motion of J. C. Benson, the amendments to the by-laws and rules were unanimously approved. Attendance 38. Attendance ratio 0.20.

• *WESTERN MICHIGAN*: S. H. Downs, past president of the Society, introduced the guest speaker, L. N. Hunter, second vice president of the Society, and vice president, Research, The National Radiator Co., Johnstown, Pa. Mr. Hunter's subject was *Testing and Rating Low Pressure Steam Boilers.* His talk covered the rating of steam boilers by the different associations governing the manufacture of boilers. Mr. Hunter illustrated his talk with slides.

The January meeting was called to order by Pres. H. R. Limbacher. Various committees made their reports. Attendance 64. Attendance ratio 0.50.

Rocky Mountain Chapter Invites All Members to Attend the Semi-Annual Meeting 1953 in Denver Capital of the "CENTENNIAL STATE"
(see page 133)

• *WESTERN NEW YORK*: Q. P. Thompson, secretary, read an invitation to the membership from the *Engineering Society of Buffalo* which invited them to attend the January 15th meeting on *Smoke Abatement.*

C. W. Stone, program chairman, gave a short resume of the coming meetings. F. J. Weber introduced the guest speaker, Henry Wright, technical consultant, Herman Nelson Division, American Air Filter Co., Moline, Ill. Mr. Wright was introduced as a former editor of *Design Plus* and *Architectural Forum.* His subject was *Classroom Heating and Ventilating Observations at the Demonstration School in Moline.* Mr. Wright illustrated his talk with slides.

Pres. J. M. Quackenbush called the January meeting to order at the University Club. Attendance 71. Attendance ratio 0.70.

STUDENT BRANCHES

• *OKLAHOMA A & M*: C. L. Foley, J. C. Egger, Jr., and M. J. Myers presented their applications for membership at the December meeting. Elliot Todd, Jr., was introduced and asked for an application.

The topics discussed were membership drive and obtaining lecturers for the group. At this meeting it was also decided that election of new officers would take place in the second semester.

The meeting, which was held at the Engineering Building, was called to order by acting president H. G. Rice. Attendance 7.

• *UNIVERSITY OF TORONTO*: Pres. D. S. Harper introduced the guest speaker, J. H. Ross, consulting engineer and president of the Ontario Chapter. His topic was *Present Trends in Heating.* Mr. Ross emphasized radiant heating. He used colored slides to illustrate his discussion.

The meeting was held at the Mechanical Engineering Building. Attendance 14. Attendance ratio 1.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 130 applications for membership, including 2 student applications and 5 reinstatements; in addition 11 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by March 31, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

Arkansas

HARRIS, W. T., Contractor, Arkansas Mechanical Contractors, North Little Rock. REFERENCES: Joe Adam*, E. W. Daniel*, G. S. Daunis*, G. W. Tompkins.

California

BARNES, W. E., Designer, Hughes Aircraft, Culver City. REFERENCES: E. F. Adams, R. C. Johannesen, Robert Miller*, M. C. Wong.

KUNZ, W. D., Engr., Fiberglas Engineering & Supply Co., Sacramento. REFERENCES: M. J. Delavan, E. B. Green, A. L. Hughes*, M. B. Quillen.

LAWRENCE, D. R., Instructor, California State Polytechnic College, San Luis Obispo. REFERENCES: Hugh Haroldson*, H. P. Hayes*, H. E. Newman, Norman Sharpe.

LESKY, E. A., Mech. Engr., U. S. Corps of Engineers, Sacramento. REFERENCES: M. C. Cady*, E. C. McKinsey, E. E. Phillips, Norman Sharpe.

△PRIBUSS, R. C., Engr. & Estimator, C. R. Reichel Engineering Co., San Francisco. REFERENCES: H. L. Duncan, J. E. Murray, Eric Roberts, H. R. Scandrett.

REECE, R. R., Engr., Coldaire Refrigeration Co., Sacramento. REFERENCES: Lamont Foster*, A. L. Ottum, E. A. Nickelsen*, O. O. Taylor*.

SEGAL, M. R., Owner, Bee Metal Products & Engineering, Long Beach. REFERENCES: J. S. Earhart, J. P. Haffey, J. L. McCullough, J. D. Owen.

Colorado

SLOCUM, C. S., Pres., Claude S. Slocum Co., Denver. REFERENCES: Fred Janssen, E. A. Norman, Jr., D. D. Piper, William Van Genderen.

WHITTLESEY, R. L., Owner, Whittlesey and Associates, Denver. REFERENCES: G. C. Andresen, C. F. Bieler*, W. C. Muchow*, J. S. Sudler*.

Connecticut

HENDERSON, S. D., Sales Engr., The Trane Co., West Hartford. REFERENCES: C. W. Freeman, W. G. Lathrop, R. J. Pinto, H. B. Van Zelm.

△MEULENDYKE, BRUCE, Design Engr., Electric Boat Div. of General Dynamics Corp., Groton, Conn. REFERENCES: J. E. Blanding*, F. L. Minson, A. F. Steeves*, R. G. Wyld*.

Georgia

△CROLEY, J. G., Sales Mgr., Carrier Atlanta Corp., Atlanta. REFERENCES: L. L. Barnes, G. B. Hightower, H. K. McCain, S. L. North.

DAUGHERTY, C. F., JR., Chief Engr., Carrier Atlanta Corp., Atlanta. REFERENCES: L. L. Barnes, T. A. Barrows, J. G. Croley, S. N. Roberts.

Illinois

△LIPPITT, A. W., Mech. Engr., Skidmore, Owings & Merrill, Chicago. REFERENCES: C. W. Johnson, Sam Sachs, H. H. Van Epps, C. M. Vreuls.

RUDDY, D. J., Secretary, Ruddy Bros., Inc., Aurora. REFERENCES: M. I. Harden*, Ken Long*, Karl Moore*, George Peters*.

Iowa

OLSON, R. E., Engr., William E. Nanes, Des Moines. REFERENCES: E. H. Borg, J. E. Borg*, W. E. Nanes, J. F. Sandfort.

Kansas

LUDWICK, R. H., Engr., J. M. O'Connor, Inc., Wichita. REFERENCES: Carl Clegg, H. J. Leverance, W. F. Ryan, R. W. Winget.

WIEBE, H. J., Pres. and Chief Engr., Radiant Heating, Inc., Wichita. REFERENCES: R. F. Bauer, J. J. Clark*, Robert Feagins*, R. R. Rotelli*.

Louisiana

LEININGER, J. E., Cons. Engr., New Orleans. REFERENCES: Walter Cooke, L. V. Cressy, C. B. Gamble, V. F. Self.

SCOTT, H. E., Repr., Minneapolis-Honeywell Regulator Co., Shreveport. REFERENCES: J. C. Cox, W. E. Fitzgerald, R. M. Hood, R. S. Segall.

URQUHART, D. W., Engr., Minneapolis-Honeywell Regulator Co., New Orleans. REFERENCES: F. C. Brandt, Ralph Elizardi, C. B. Gamble, W. G. Moses.

Massachusetts

NICKEL, H. J., Mech. Engr., Jackson & Moreland, Boston. REFERENCES: G. D. Fife, S. O. Johnson, W. H. Shipp, G. W. Sprague.

THORLEY, F. W., Engr., Albert Thorley Co., South Boston. REFERENCES: W. K. Cashin, M. I. Kishler, G. E. MacNeill, W. F. Martin, Jr.

Michigan

JOHNSON, H. D., Construction Mgr., Carrier Corp., Detroit. REFERENCES: W. A. Bingham, Jr.*, R. T. Mitchell*, Albert Petronis, E. W. Snyder*.

LARER, D. P., JR., Sales Engr., David S. Falk Co., Detroit. REFERENCES: W. E. Barnum, Jr., J. S. Blossom, D. S. Falk, E. F. Glanz.

OCZAN, E. J., Indus. Engrg. Repr., Michigan Consolidated Gas Co., Detroit. REFERENCES: Hale Clark*, G. E. Marble, Dave Spahr*, George Wilson*.

SHEPARD, L. I., Engr., Ray Engineering Co., Detroit. REFERENCES: D. C. Jones, J. I. Sprott, C. A. Strand, H. P. Zorb.

†SMITH, V. D., Mechanical Designer, Albert Kahn & Assocs., Detroit. REFERENCES: Saul Saulson, G. S. Whittaker, H. E. Ziel, P. H. Ziel.

TREICHLER, W. W., JR., Graduate Student, Michigan State College, East Lansing. REFERENCES: J. T. Anderson, L. G. Miller, C. H. Pesterfield, R. J. Waalkes.

WILEY, G. S., Assoc. Dir. of Research, Bundy Tubing Co., Birmingham. REFERENCES: G. W. Cassell,* M. W. Davenport,* R. H. Hobrock,* D. R. Knox.*

Minnesota

KELLEY, L. H., Head of Engrg. Dept., Reuben L. Anderson, Inc., Minneapolis. REFERENCES: E. J. Burns, G. M. Kendrick, R. W. Otto, W. F. Uhl.

JOURNAL SECTION

LEVIN, A. E., Estimator, Humboldt Plumbing & Heating, Minneapolis. REFERENCES: R. E. Bishop, S. B. Gruenberg, C. T. Hasting, D. L. Vandergon.

NICKISCH, H. G., Mgr., Htg. & Pump Dept., Lindsay Brothers Co., Minneapolis. REFERENCES: L. J. Krause, M. A. Lindberg, B. F. McLouth, B. J. Mulcahy.

Mississippi

BROU, P. E., Mechanical Inspector, City of Jackson, Jackson. REFERENCES: J. G. Coleman, Burt Lomax, Jr., B. L. Palmer, O. F. Rogers.

CHANTOS, A. J., Repr., American Radiator & Standard Sanitary Corp., Jackson. REFERENCES: F. L. Cooper, Burt Lomax Jr., O. F. Rogers, I. E. Rowe.

POOLEY, S. R., Owner, South Central Htg. & Plbg. Co., Jackson. REFERENCES: N. A. Bortz, J. G. Coleman, W. H. Lambeth, Burt Lomax, Jr.

PORTER, ROBERT, Manufacturer's Agent, Jackson. REFERENCES: Burt Lomax, Jr., W. F. Peters, III, V. F. Self, C. M. Wilson.

VERNON, R. E., Owner, A-T-M Gas Equipment Co., Jackson. REFERENCES: H. M. Ludlowe, O. F. Rogers, I. E. Rowe, J. L. Scott.*

WINDERS, W. H., Estimator, Winders Equipment Co., Jackson. REFERENCES: S. W. Chandler*, W. H. Lambeth, Burt Lomax, Jr., O. F. Rogers.

Missouri

CARLSON, R. G., Engrg. Draftsman, Howarth, Scott & Kinney, Kansas City. REFERENCES: W. E. Howarth, O. W. Kinney, A. R. Scott, E. C. Sneegas.

JORDAN, H. L., Partner, Manufacturers Sales Co., Kansas City. REFERENCES: D. E. BREWER, J. R. De Rigne, O. A. Forslund, P. E. C. Massaglia.

KAENTER, R. J., Warm Air Htg. Specialist, American Radiator & Standard Sanitary Corp., St. Louis. REFERENCES: B. L. Evans, J. T. Lynch, C. O. May, G. B. Rodenheiser.

TOMPKINS, B. J., JR., Combustion Engr., Sinclair Coal Co., Kansas City. REFERENCES: T. C Cheasley, E. L. Davis*, G. L. Kirp*, H. V. Mansfield*.

Nebraska

HARKNESS, W. G., Mgr., Heating Dept., Crane Co., Omaha. REFERENCES: F. E. Hawley, W. B. Howard, M. K. Rush, O. J. Smith.

PAULSEN, L. J., Engr., Minneapolis-Honeywell Regulator Co., Omaha. REFERENCES: G. W. Colburn, C. A. Goth, K. R. Magarrell, K. E. Martin.

PRATT, ORVILLE, Engr., U. S. Supply Co., Omaha. REFERENCES: S. W. Black, C. A. Goth, B. G. Peterson, Verne Simmonds.

THOMSEN, C. L., Mech. Engr., Leo A. Daly Co., Omaha. REFERENCES: J. D. Edwards, F. P. Manchester, R. E. Mason, G. E. Merwin.

New Jersey

BRATT, R. T., Mgr., Esso Standard Oil Co., Elizabeth. REFERENCES: M. C. Christesen, Fred Kaissl, Jr.*, J. C. Morgan*, S. H. Nitzberg.

BRUNS, H. C., Owner, Oradell. REFERENCES: M. C. Christesen, H. P. Morehouse, S. H. Nitzberg, B. F. Thomas, Jr.

BURG, G. W., Secy.-Treas., Aerodyne Engineering, Inc., Clifton. REFERENCES: Henry Griffen*, B. R. Morrison, I. Phillips*, P. H. Oppenheimer.

DENNIS, G. V., President, George L. Dennis Co., Inc., Newark. REFERENCES: William Caddle, A. F. Hinrichsen, W. O. Huebner, B. P. Hyde.

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OBITUARIES

JOSEPH L. CLARKE
Indianapolis, Ind.

The Society has recently been notified that Joseph L. Clarke, owner of Clarke Brothers Plumbing Co., passed away on November 4, 1952.

Mr. Clarke was born in 1883 in Indianapolis, Ind. He studied at Manual Training High School, and received his formal education at St. Joseph's Institute where he studied heating, plumbing and air conditioning. In 1906 he entered into business for himself, and was self-employed to the time of his death. In the Clarke Brothers Plumbing Co., he was active in plumbing, heating, ventilating and air conditioning. Mr. Clarke himself did the estimating of the jobs which came up.

Mr. Clarke was a member of the Rotary Club, and is survived by his sister, Mrs. Katherine O'Brien, of Indianapolis to whom the Officers and Council of the Society express their deep sympathy.

PAUL R. HOFFMANN
Milwaukee, Wis.

Word has been received by the Society that Paul R. Hoffmann, a member since 1946, died on December 12, 1952.

Mr. Hoffmann was born on April 8, 1883 in Germany, where he received his schooling. In 1924 he settled in Wisconsin and went into business for himself by representing the Bell & Gossett Co., of Morton Grove, Ill. in the state of Wisconsin. In 1933 Mr. Hoffmann also became a representative for McDonnell & Miller of Chicago, Ill., in that same year, also adding the Dole Valve Co. of Chicago. At the time of his death his duties were those of sales engineer and manufacturer's representative for the three firms. He had specialized in forced hot water heating, panel heating and indirect water heating.

Mr. Hoffmann is survived by Mrs. Alma S. Hoffmann to whom the Officers and Council of the Society express their sympathy.

LEONARD H. ROONEY
Madison, N. J.

It was with sorrow that the Society learned of the sudden passing of Leonard H. Rooney from a heart attack on November 2, 1952. Mr. Rooney, who was employed by Minneapolis-Honeywell Regulator Co., had been a member since 1948.

Mr. Rooney was born on November 28, 1903, in Newark, N. J. and received his formal education at the Newark Institute of Technology. From 1923 to 1928 he was employed with Wallace & Tiernan Co. of Belleville, N. J. where his duties were those of draftsman, service and sales engineer, and office management. In 1928 he joined the Mathieson Alkali Works where he sold chemicals until 1932. That year he became connected with Grant Manufacturing Corp. as a sales engineer of heating industrial ovens. From 1943, to the time of his death, Mr. Rooney was with Minneapolis-Honeywell in the capacity of sales engineer of temperature control equipment.

Mr. Rooney is survived by Mrs. Leonard H. Rooney, to whom the Officers and Council of the Society express their profound sympathy.

THOMAS J. SHERIDAN
New York, N. Y.

Members of the heating and engineering profession were greatly saddened to hear of the death of Thomas J. Sheridan on November 30, 1952.

Mr. Sheridan was born on January 10, 1897 in Jersey City, N. J. He received his formal education at The College of the City of New York and also at New York University. He also attended private courses given by industrial firms. He specialized in heating, air conditioning, drafting, refrigeration and layout. From 1935-1947 he was associated with the Burns Brothers Co. where he sold fuel to domestic, commercial and industrial users for heating and power. He was especially qualified in estimating and designing heating systems. While he was actually engaged in the sale of fuels he did the preliminary engineering and survey, and made specific recommendations and calculations for many coal users who were converting to oil. Mr. Sheridan was also active in the fields of ventilating and air conditioning.

He was Past President and Chairman of the Board of the *Anthracite Industries Alumni Association* for the New York area.

CHARLES A. BOOTH
Buffalo, N. Y.

Members of the profession together with civic and industrial leaders of Buffalo and Erie County were greatly saddened to learn of the passing of C. A. Booth, executive vice president of Buffalo Forge Co., Buffalo, N. Y., on January 31, 1953. A member of the Society since 1917, and Life Member since 1946, Mr. Booth was active in organizing the *NAFM* and elevating the engineering standards of the industry.

Born in Southbridge, Mass., he graduated from Worcester Polytechnic Institute in 1898, and taught for a year at Williston Academy in Massachusetts. He joined the Buffalo Forge in 1900, and became general sales manager in 1907. In the early part of the century there was little information available on air moving and air conditioning, and Mr. Booth was instrumental in helping the growth of this industry. In addition to being a Past President of the *NAFM*, and Life Member of ASHVE, he was a member of *ASME*. Prominent in civic affairs he was a member of *F&AM*, The Buffalo Club, Cherry Hill Golf Club and Buffalo Canoe Club and active in the *Rotary*. He was honored in 1950 by the officers and directors of his company with a formal dinner on the occasion of his 50th anniversary with the Buffalo Forge Co., having served as executive vice president since 1920.

Mr. Booth is survived by his wife, a son and four grandchildren to whom the Officers and Council extend their profound sympathies.

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ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(52 Chapters—1 Special Branch—9 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, Herman Cumnock, 401 W. Capitol Ave. SECRETARY, W. J. Franklin, 1516 S. Pierce St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. G. Croley, 400 Batavia St., East Point, Ga. SECRETARY, T. A. Barrow, 157 Simpson St., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. R. Kent, 2322 N. Charles St. (18). SECRETARY, A. M. Kroft, 3935 Stokes Dr. (29).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. PRESIDENT, M. E. Minaker, 1128 Burrard St. SECRETARY, D. W. Thomson, 445 Richards St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, F. E. Krell, 116 Fernwood Ave. (5). SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, A. D. Bogen, 330-34 E. Livingston Ave. (15). SECRETARY, J. A. Guy, 219 King Ave. (1).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, H. E. Russell, 4th & Main Sts., Box 960. SECRETARY, F. W. Wilson, 222-24 E. 14th St.

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, T. L. Arnold, 26 Francis Ave., Hartford (6). SECRETARY, C. L. L'Hommedieu, 76 Blatchley Ave.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, Walter Cooke, 816 Howard Ave. (13). SECRETARY, T. J. Jenny, 1000 S. Peters St. (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, Harry Horowitz, 889 Warren St. (3). SECRETARY, R. J. Tougher, Menands Rd., Loudonville, N. Y.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. White, 625 Market St. (5). SECRETARY, Eric Roberts, 417 Market St. (5).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, M. W. Bishop, Rm. 1504, 228 N. LaSalle St. (1). SECRETARY, G. V. Zintel, 1217 W. Washington Blvd. (7).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, J. T. Hardin, 720 Noble St. (2). SECRETARY, P. O. Patterson, 2701 Roosevelt Ave., (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, T. P. Nau, S. 1419 Walnut (9). SECRETARY, H. A. Bickel, E. 7 Riverside Ave.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, R. H. Schnell, 1617 33rd St. (11). SECRETARY, Bowen Campbell, 1435 Casady Dr. (5).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, O. P. Bullock, 254 Laura (7). SECRETARY, H. D. Speyer, 120 Ida.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, W. A. Reichow, 1621 E. 31st St. (3). SECRETARY, J. G. Barnes, Jr., 1924 Oak St.

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, W. J. Atkinson, 812 Boyd Bldg. SECRETARY, Ernest Lambert, 93 Lombard St.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, Rm. 606, 79 Milk St. (9).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, D. L. Bergman, Box 95, Riverdale Sta. (5). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, C. A. Strand, 9117 Hamilton Ave. (2). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, William Sturm, 2160 Highland Pkwy., St. Paul (5). SECRETARY, J. G. Hamm, 850 Cromwell Ave., St. Paul (4).

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, W. G. Hole, 7035 Grand Ave. (14). SECRETARY, D. L. Lindsay, 1411 Crescent St. (25).

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 608 City Hall (2).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, P. B. Gordon, 222 E. 41st St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. E. Sherman, 570 Hanna Bldg. (15). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 2307 Fairfield Ave.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, J. H. Ross, 1251 Yonge St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, K. H. Hanson, 104 S.E. Seventh (14). SECRETARY, W. R. Norte, 2225 N.E. Broadway (12).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. PRESIDENT, Bernard Stotesbury, 955 Somerset St. W. SECRETARY, E. J. Schoenherr, 32 Clarey Ave. (1).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, P.O. Box 7077, Riverton Hgts. Br. (88).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, M. E. Barnard, 12 S. 12th St. (7). SECRETARY, C. J. Lubking, 5060 Wayne Ave.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, N. H. Brickham, 2715 S. Humboldt St. (10). SECRETARY, A. S. Widdowfield, 1925 Blake St. (2).

● **SACRAMENTO VALLEY:** 1952. Hdqrs. Sacramento, Calif. PRESIDENT, L. A. O'Meara, 1400 Tenth St. SECRETARY, J. E. Marshall, 441 Pico Way (19).

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, C. H. Burnap, 235 Keruish Pl., Webster Groves (19). SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave. (4).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, W. S. Evans, 614 Johnson Bldg. SECRETARY, J. S. Malahy, Jr., 1839 Line Ave.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, C. L. Fleming, 809 M. & M. Bldg. SECRETARY, J. W. Holland, 245 Esperson Bldg. (2).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, J. S. Earhart, 2734 Fleur Dr., San Marino (9). SECRETARY, C. D. Walz, 3600 San Pasqual St., Pasadena (10).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. M. Warren, Jr., P.O. Box 1755, Charlotte. SECRETARY, J. A. Rice, P.O. Box 1755, Charlotte.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● **UTAH: 1944.** Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, D. R. Wilde, 2634 S. 19th E. (1). SECRETARY, Alfred Richeda, P.O. Box 479 (9).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, G. R. Walz, 5214 25th Pl. N., Arlington (7) Va. SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N.W. (6).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, H. R. Limbacher, 760 E. Vine St., Kalamazoo. SECRETARY, F. K. Platt, P.O. Box 307, Kalamazoo.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, J. M. Quackenbush, 505 Franklin St. (2). SECRETARY, Q. P. Thompson, 260 Richmond Ave. (22).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, J. A. Lofte, 2505 N. 97th St., Wauwatosa (10). SECRETARY, I. J. Rossiter, 231 W. Wisconsin (3).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr, 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, E. M. Todd, Jr., 139 N. Duncan. SECRETARY, R. P. Schmidt, 310 S. Knoblock.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletset, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054. SECRETARY, W. C. Haggard, Box 5227.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.

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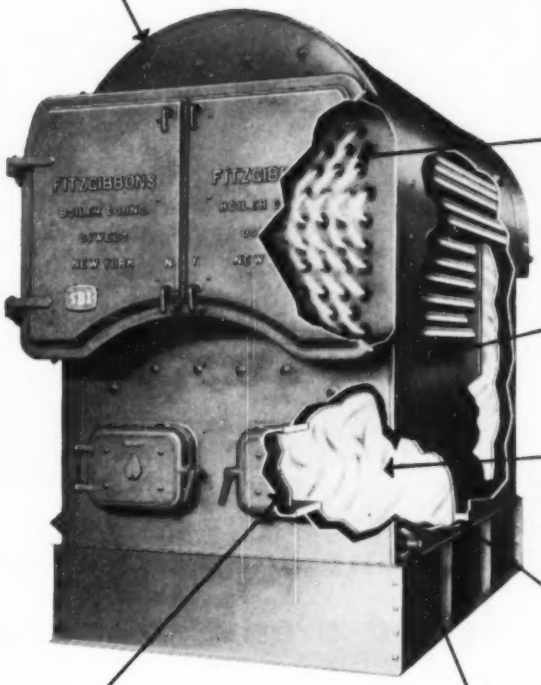

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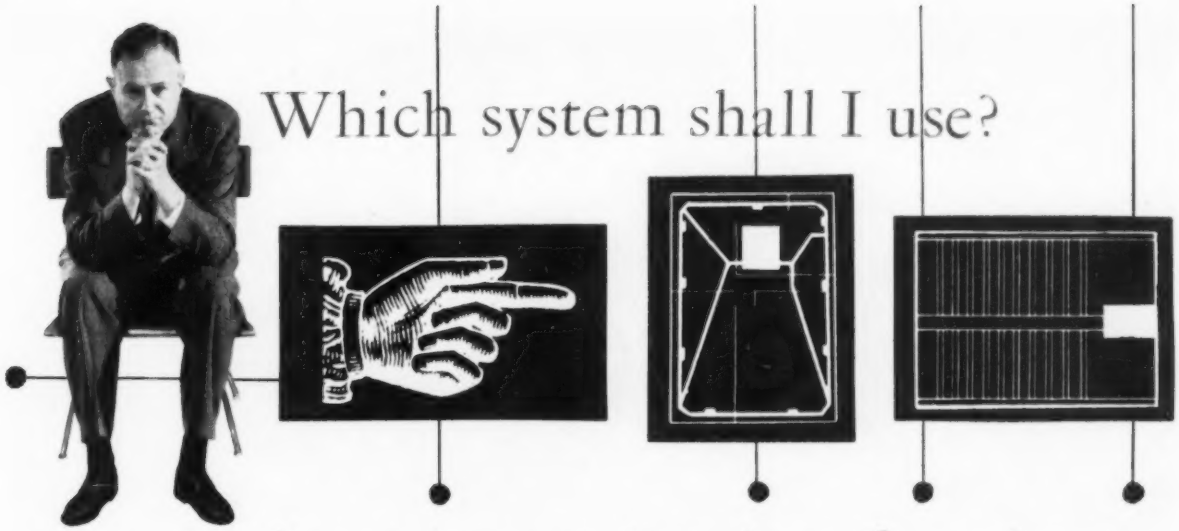

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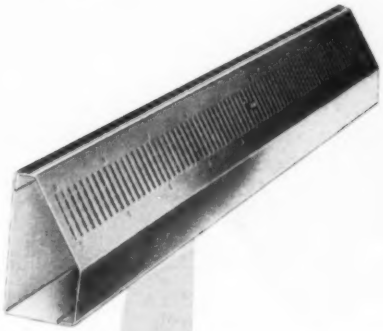

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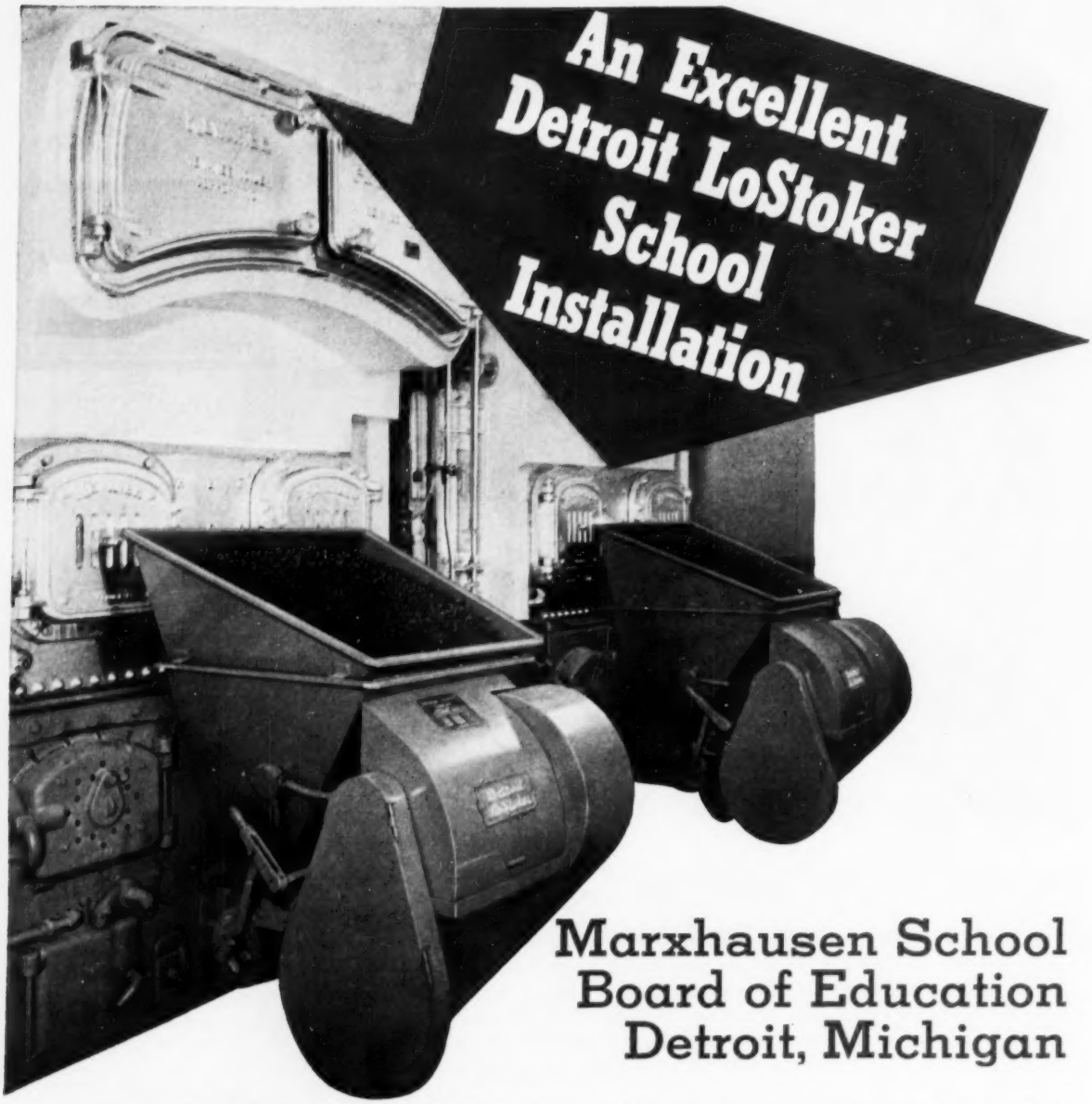

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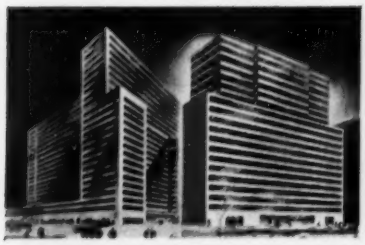
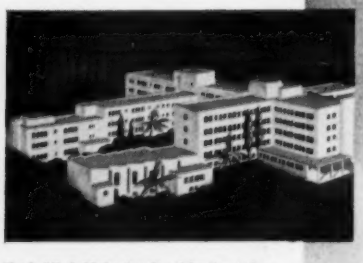
"PIPE WITH THE YEARMARK"

Scrap is urgently needed to help keep America strong and free. Do your part — get in your scrap today!

HOW York's Advanced Systems take the compromise out of air conditioning



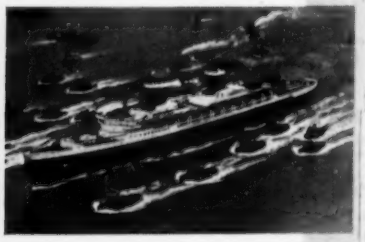
York Unitary System in world's first fully air conditioned skyscraper apartments—Philadelphia's Rittenhouse Claridge and Savoy. One central station with individual room controls.



York High Velocity Double Duct System was selected by the St. Francis Hospital in Lynnwood, Calif. to meet the exacting requirements of one of the world's most modern hospitals.

York Turbo Cooling Systems in Empire State Building shoot a column of ice water to cloud level to provide individual air conditioning for occupants. Tenants select room unit they prefer.

Battery of Giant York Turbo Compressors—heart of the air conditioning in the world's fastest luxury liner, the new S. S. United States. Equipment could air condition average suburb.



Beautiful room unit with self-contained controls.
Compact pipe system saves 85% of space.
York High Velocity Air Induction System provides year-round air conditioning. As much as 10% rental space is gained. Adaptable without sacrifice of interior design. In existing buildings, minimum of cutting and patching is required.
Heart of system—giant York Turbo Compressor.

Making a system fit a building or radically changing a building to fit a system . . . that's neither good engineering nor is it good business.

With the industry's *widest* range of equipment at their command, York engineers sit on *your* side of the desk. They are not obliged to sell—or try to adapt—a fixed system to your special requirements.

Backed by ever-expanding factory research and development that has followed one profession for 68 years—*mechanical cooling*—York Engineers can recommend the precise system to give you better performance, longer life at low initial and operating costs.

A consultation can result in vital savings in time, money and worry for you. You'll find the nearest York Engineering Office listed in your Classified Telephone Directory. Or, if you prefer, write to York Corporation, York, Pennsylvania.

YORK AIR CONDITIONING AND REFRIGERATION
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

Fan and blower mounts... compressor units

Insulation materials... refrigeration lines

Ventilator hoods... duct straps

Pipe hangers... control units and wiring

Unit heater supports... sheet metal work

Beat down fastening costs, into steel or concrete with super-speed Ramset Jobmaster

FASTENING SYSTEM

Prove for yourself the dollar-and-cents economy and amazing time saving by doing fastening jobs like these, and many others, with RAMSET JOBMASTER and Tru-Set Fasteners. Without any obligation, your local dealer will show you, right on the job, how thousands of RAMSET users have profited, for six years, from the super-speed RAMSET SYSTEM.

Compare JOBMASTER split-second fastening with any other method. See the compact, light-weight, one-piece tool, with fast opening and loading, trigger action and one-hand operation. Watch how Roto-set safety shield, angle fire control and the exclusive Red-Tip Pilot assure perpendicular contact of Tru-Set Fasteners with the work, for straight, firm penetration and highest efficiency.

* SEND FOR "HOW-TO-DO-IT" BOOKLET

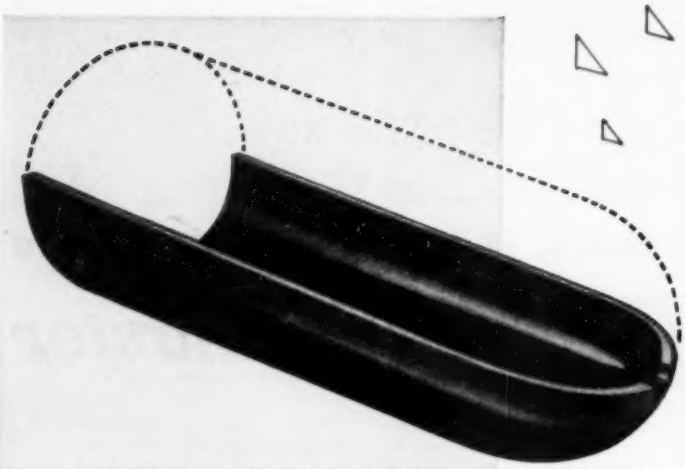
Gives detailed suggestions and diagrams for scores of jobs. Tells how to select the best Tru-Set Fastener and power charge. Points out many ways to do your fastening work faster, easier, at lower cost, with RAMSET SYSTEM. Ask your RAMSET dealer for your copy of *Modern Fastening Methods* or write us.

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.

12117 BEREA ROAD • CLEVELAND 11, OHIO

How Tubular Parts with Formed Ends Can be Produced most **ECONOMICALLY**



Here is a typical case of economy. Shown is a section of a cylindrical part now made in one piece from Wolverine tube with both ends almost closed by means of the Wolverine Spun End Process.

Having no seams or joints, this redesigned part offers assurance against leaks; and makes the complete unit more dependable at all times.

This product was formerly made from a cylindrical form capped at both ends and silver soldered at the joints.

*A PATENTED PROCESS RE. 22465.

Tubular parts requiring tapered, rounded, flat or other shaped ends can be made easily, quickly and economically by the Wolverine Spun End Process*.

By virtue of their improved design, the finished parts made by this process perform more efficiently, and their modern lines add to the sales appeal.

This streamlined design also has the advantage of eliminating several parts, thereby reducing labor and material costs and assembly time as well.

A request on your letterhead will bring you a copy of our brochure "Spun End Process."

Other Wolverine Products

CAPILATOR*
—the capillary tube for restriction purposes
COMMERCIAL TUBE
AUTOMOTIVE TUBE
CONDENSER TUBE
COPPER WATER TUBE (K-L-M)
ELECTRIC WELDED STEEL TUBE
FABRICATED TUBULAR PARTS
WOLVERINE TRUFIN*
—the integral finned tube
REFRIGERATION AND AIR CONDITIONING TUBE (Plain or Tin Plated)
S.P.S. PIPE
SPUN-END TUBE†

*Reg. U.S. Pat. Off.
† A Patented Process RE 22465

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario

WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.
Manufacturers of Tubing Exclusively
1419 CENTRAL AVENUE • DETROIT 9, MICHIGAN
Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

ESTABLISHED 1916

install piping runs

with Versatile

UNISTRUT®

METAL FRAMING

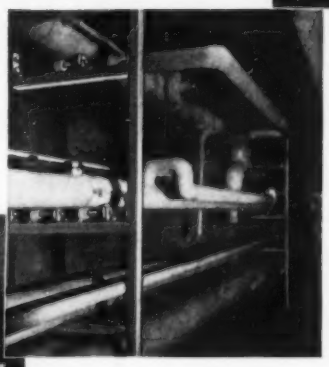
The modern way to rack piping

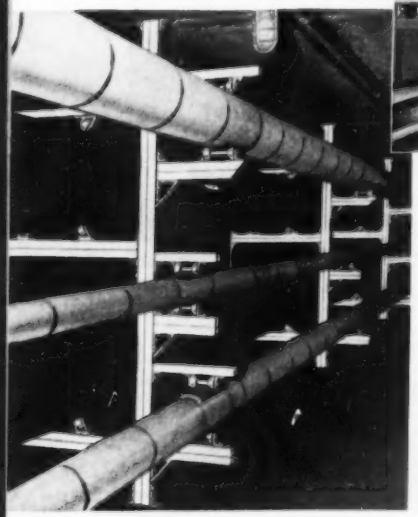
Tunnel job showing how UNISTRUT continuous run concrete inserts can be installed vertically or horizontally, or at any angle required.

UNISTRUT Products are Bonderized

Typical piping installation supported by UNISTRUT framing, concrete inserts and roller pipe supports. Slotted channel permits attachment of fittings at any desired point.

Note how UNISTRUT framework's great strength easily supports long runs of heavy piping, including bulky 16" chilled water lines.





Adjustable Framing System

assures exact pitch, permits changes or additions at any time—no special tools or equipment needed.

Conserves Steel, Reduces Manpower Hours, Cuts Over-all Costs

The UNISTRUT system of mechanical supports includes steel channel, roller pipe supports, concrete inserts, brackets, clamps, pipe hangers and many other standard parts which combine to form the world's most flexible system of support or suspension.

You save time in engineering detailing and eliminate the need for trained erection crews—you get fast, on-the-job framing assembly where adjustments are made and supporting members added as the work progresses. Try it on your next piping job!

Write for NEW Free 84-page Pocket Catalog No. 800!

U. S. Patent Numbers
2327587 2329815 2345650
2363382 2380379 2405631
2541308 Other Patents Pending

UNISTRUT®

The World's Most Flexible All-Purpose Metal Framing

For the Man on the Job!
84 pages packed with photos, drawings, ideas and data on how to frame, mount, rack, hang and support all kinds of mechanical and electrical equipment with adjustable UNISTRUT metal framing.

Distributors and Warehouse Stocks in Principal Cities. Consult your Telephone Directories.

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd., Chicago 7, Ill.
Dept. H3

Please send me a copy of the new UNISTRUT Pocket Catalog No. 800, without obligation.

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

Here's the answer to simple, efficient, economical year 'round air conditioning

The REMOTAIRE
by AMERICAN-Standard

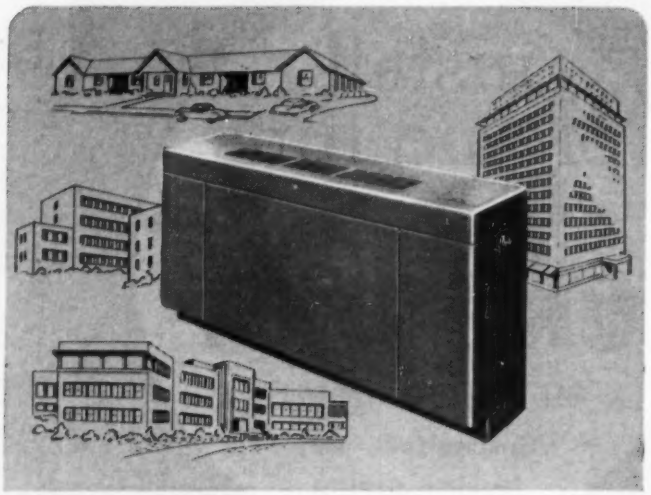
a new remote type unit for multi-room installations

Heats in Winter
Cools in Summer

■ The Remotaire is an individual room remote type unit for providing year 'round air conditioning for central plant multi-room installations.

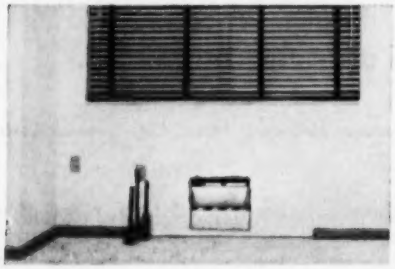
The Remotaire, as part of a Remotaire system, uses chilled water from a central water chiller for cooling and hot water from a central heating plant for heating. Individual control of each unit allows the occupant to choose the room temperature that suits him best without affecting adjoining spaces.

The Remotaire is enclosed in an attractive cabinet of sturdy, reinforced steel—plus a reinforced air grille—which adds to permanence and long-lasting beauty of unit. Designed for location under windows, this unit can be free standing or recessed into wall four inches.

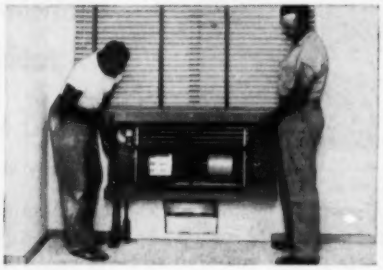


For hotels, motels, apartments, hospitals, offices and industrial buildings and other types of installations.

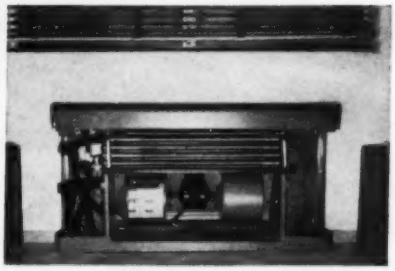
The REMOTAIRE Wall Aperture System is ideal for New Construction



LOCATION READY for Remotaire shows wall aperture, water supply, return, and condensate pipe stubs, and wall plug for electrical connections.



REMOTAIRE is set in place and leveled. Piping and electrical connections are made and pipe insulation applied.



HERE IS THE REMOTAIRE (with panels removed) showing the piping and electrical connections and pipe insulation completed.

As shown in the pictures above, the Remotaire, as part of a Remotaire Wall Aperture System, can be readily installed in the average building since piping connections are the principal installation requirement. Ventilation air is introduced through a small wall aperture behind each unit thus eliminating use of large, expensive, space-consuming ductwork. Other Remotaire systems, using other methods of ventilation, are ideal for modernization as well as new construction. Write for Remotaire Brochure, Form 298.

American Radiator & Standard Sanitary Corporation
P. O. Box 1226, Pittsburgh 30, Pennsylvania

AMERICAN-Standard
HEATING-COOLING

Serving home and industry:

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE
DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

T. M. 50

User Reports

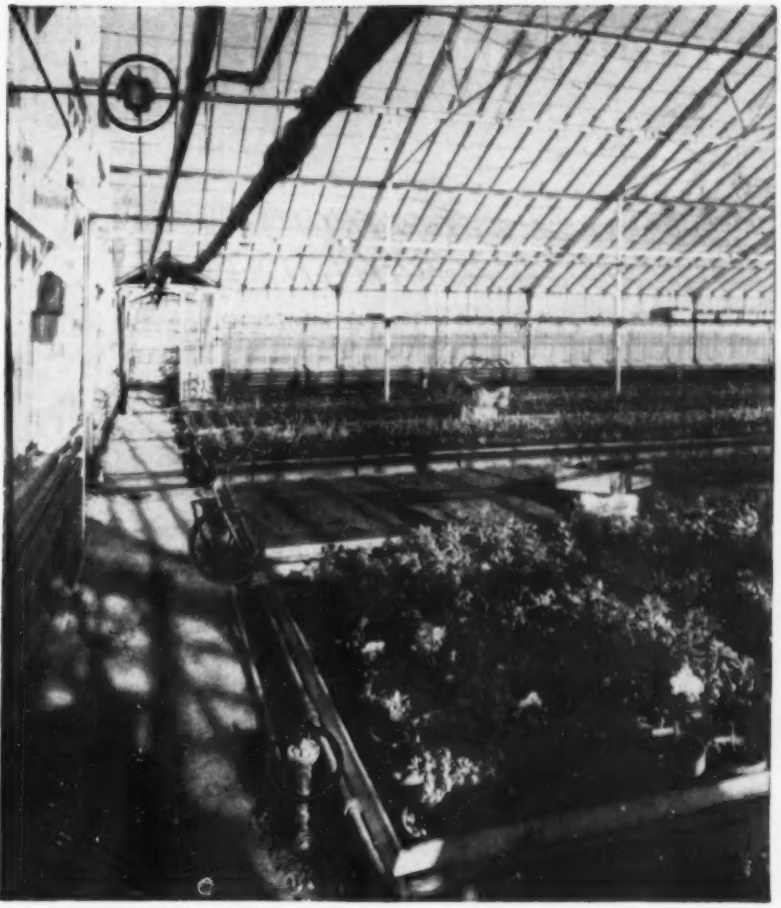
ARMSTRONG "UNIT TRAPPING"

cut his fuel bill

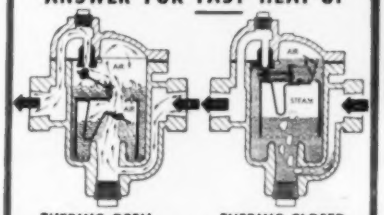
20%

and speeded heat-up

15%



"BLAST" TRAPS PROVE TO BE ANSWER FOR FAST HEAT-UP



THERMIC OPEN — THERMIC CLOSED

Where steam is turned on and off periodically, blast traps give really fast heat-up, provided accumulated air and condensate is pocketed and will be pushed out ahead of incoming steam. A large auxiliary thermic vent in the bucket opens when the trap is cold, letting air whistle right through trap. When trap reaches 210°F the thermic vent closes and trap operates as a standard trap (see drawings above). Blast traps are ideal for single pipe coils, small on-and-off unit heaters, on-and-off multiple coils, drip points, etc. See page 39 of The Steam Trap Book.

Experience of Greenhouse Owner Points Way to Greater Efficiency in Any Plant . . .

THE problem of operating steam heated equipment efficiently is basically the same whether you operate a greenhouse, a refinery or a food processing plant. That is why the experience of Reiss' Greenhouses, Minneapolis, should prove of interest and value to you.

By replacing old, inefficient steam traps on heating piping with an individual Armstrong "blast" trap on each coil, Reiss' cut its fuel bill exactly 20% and speeded-up heating of cold coils by 15%.

This benefit was gained solely because Armstrong traps drain condensate and air from steam heated units as fast as it accumulates and without leaking steam. In Reiss' case the "blast" traps described at the left were particularly beneficial, and may be in your case. For complete information call your local Armstrong Representative, or write:

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Michigan

You Get More Out of Your Fuel When You Use Armstrong "Unit Trapping"

SEND FOR YOUR FREE COPY OF THE 44-PAGE ARMSTRONG STEAM TRAP BOOK!

Complete data on selection of traps for all types of equipment plus installation and maintenance recommendations, trap list prices and physical data.

JUST CLIP THIS TO YOUR COMPANY LETTERHEAD AND MAIL:

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Michigan

Please send me The Steam Trap Book.

Name_____

Title_____

T-M 50

Thrush advanced engineering means

More Circulator

FOR YOUR MONEY

BUILT FOR *Lifetime* SERVICE

more compact • lighter in weight

Designed and Powered For Full Rated Capacity

HERE ARE Circulators of improved design to meet today's hot water heating needs. They will fit more places, give better service and help you get more jobs. Here's why —

- ✔ *Rugged.* Powerful motors with overload protection. No sacrifice in horsepower.
- ✔ *Vibration-free.* Flexible coupling and strong spring mounting eliminate noise.
- ✔ *Sealed-in lubrication.* Perfectly balanced impeller. Fully enclosed bracket.
- ✔ *Ideal for zoning.* Sizes to fit every heating requirement. Easier to install.

THRUSH
HORIZONTAL WATER CIRCULATORS

For more facts about Thrush job-rated Circulators, see your wholesaler or write Dept. E-3.

H. A. THRUSH & COMPANY

PERU • INDIANA

ILLINOIS
Float & Thermostatic TRAPS

Assure *lower* return line temperatures

They're different!

–in construction

–in performance

ILLINOIS Float & Thermostatic Traps operate under vacuum with the same high efficiency as under pressure. No more water-logging of mains . . . no more air binding . . . end "morning overload" troubles. The instantaneous action of the condensate valve assures complete drainage of condensate. A separate thermostatically controlled valve vents air continuously in large volume, yet positively prevents loss of steam.

Recommended Applications

Low Pressure Heating Systems, Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Large Radiators or Pipe Coils, Hot Water Generators, Drips of Mains and Risers. Draining Coffee Urns, Warming Tables, Pasteurizers, Vacuum Pans, Heat Exchangers, Process Heaters, Sterilizers, Autoclaves, Cooking Kettles, Kilns and similar equipment.

(For operating ranges from 25 inches vacuum to 15 pounds pressure use Series G Traps. For pressures up to 50 pounds use Series MG.)

Rated capacities of various size traps from 200 pounds to 5000 pounds condensate per hour, at 2 pounds differential across the trap.

Positive, Instantaneous Valve Action . . . an Exclusive Feature

The Snap Action of the Condensate Control Valve assures efficient trap operation. The valve is not directly attached to float but is actuated by impact of the dropping float. Valve action is instantaneous whether the trap is handling its maximum capacity or only a trickle of condensate and regardless of variation in pressures. The valve is either wide open or tight shut—never cracked on seat, never hanging in an intermediate position. It is water-sealed at all times. It cannot chatter and is never affected by pulsations in the flow of condensate to the trap.

Simple, Compact, Trouble-proof

No ball floats to puncture or collapse—no toggles, pins, levers or hinges to corrode, stick or bend. Hard, stainless alloy steel renewable valves and seats are used for both condensate and air bypass units. Both valve units are at the top of trap out of dirt and sludge, assuring long life and satisfactory operation without attention. Straight through connections save head room, fittings, trenching, labor, and avoid low hung piping or lifts. Trap is easily opened for inspection without disturbing piping.

TRAP NOT DAMAGED BY FREEZING. Freezing will not harm this trap in any way and it is self-thawing.

Write for Bulletin 34-C

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

"I could see the corpsman kneeling over me. The blood plasma was running down through a tube into my arm and he said everything was going to be O.K. I was walking across an enemy mine field in Seoul when one exploded and a piece of shrapnel caught me in the leg.

" 'Got enough of that stuff?' I asked him, pointing to the blood. 'I guess we never have enough,' he said, 'but you can thank *somebody* for this pint.'

"How do you thank 'somebody' for blood? For saving your life? When I got back home, I discovered the answer at my local blood donor center. There's only *one* way to say thanks—by giving some of your own blood."

"How do you thank 'somebody' for Blood?"

Yes, all kinds of people give blood—for all kinds of reasons. But whatever *your* reason for giving blood, this you can be sure of: Whether your blood goes to a combat area, a local hospital, or for Civil Defense needs—this priceless, painless gift will some'day save an American life!

Business Executives!

✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Has your company given any recognition to donors?
- ☐ Have you conducted a Donor Pledge Campaign in your company?

Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

Give Blood Now—Call Your Red Cross Today!

National Blood Program

McDONNELL 230 SERIES
SAFETY RELIEF VALVES

A line of pressure relief valves you ought to know

You should be intimately acquainted with the McDonnell 230 Series of pressure relief valves because they are, by far, the best answer to that problem of providing real pressure protection at a modest price.

Despite their moderate price they conform to all requirements of the ASME Boiler Code for both direct fired and unfired pressure vessels — wear the symbols of compliance and certified capacity ratings right on their nameplates. The series is complete, too — includes valves for hot water heating boilers and for all hot water tanks and heaters.

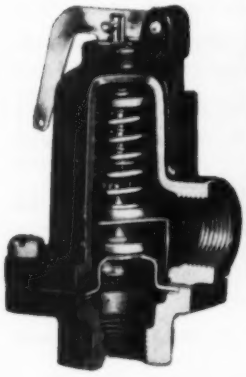
While 230 Series valves do not have the precision, stainless steel valves of the McDonnell 33 Series*, hundreds of these 230 Series Valves in service prove that they have set a new standard for relief valves of the composition disc type.

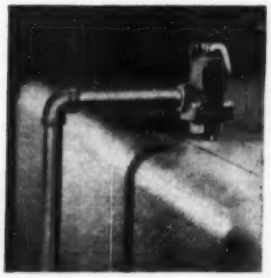
Yes, ingenious design and extensive tooling has produced a modestly priced valve without sacrificing quality. The valve seat is brass with the newest development in Silicone valve disc. All interior operating parts are non-ferrous. The sectional view shows the generous waterways and sturdy, compact construction. A typical refinement is the independently acting test lever. Lifting it tests valve operation, but tying or wiring it down does not interfere with the automatic operation of the valve.

Ask for bulletin and prices covering the 230 Series today.

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well





Your Jobber Stocks This

McDONNELL
Boiler Safety Devices

*McDonnell 33 Series Pressure Relief Valves have been developed to provide the highest quality construction available in pressure relief valves for hot water boilers and for hot water tanks and heaters. Outstanding features are stainless steel valves and seats, two-zone operation, and many other advancements. Ask for Series 33 bulletin.

Note symbols on nameplate: A.S.M.E. for American Society of Mechanical Engineers; (NB) — for National Board of Boiler and Pressure Vessel Inspectors; (V) — for fired pressure vessels; (UV) — for unfired pressure vessels.

Certified Ratings

For hot water heating boilers

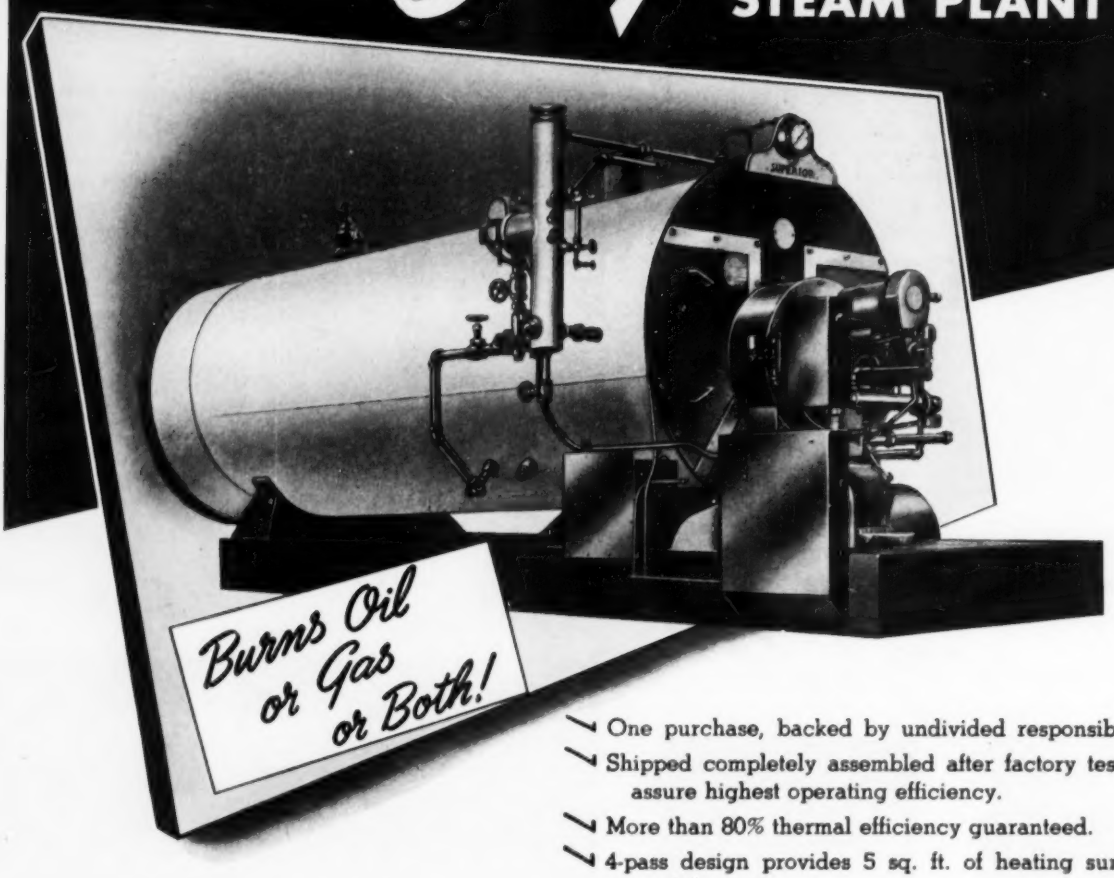
Valve No.	Opening Pressure	Certified Capacity
230-30	30 lbs.	303,000 Btu./hr.

For boilers having greater than 303,000 Btu./hr. output, 230 Series valves are available mounted on two- and three-valve assemblies. Total capacity 2-valve assembly (Product No. 2230), 629,000 Btu./hr.; 3-valve assembly (Product No. 3230), 977,000 Btu./hr.

For water tanks and heaters

Valve No.	Opening Pressure	Certified Capacity
230-45	45 lbs.	410,000 Btu./hr.
230-75	75 lbs.	502,000 Btu./hr.
230-100	100 lbs.	640,000 Btu./hr.
230-125	125 lbs.	783,000 Btu./hr.

HERE'S YOUR *Complete* STEAM PLANT



- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Heavy-duty, rugged construction assures long-lived dependability.
- Burner equipment to suit your fuel: gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.
- For complete details, write today for catalog 504.

SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES, Inc.

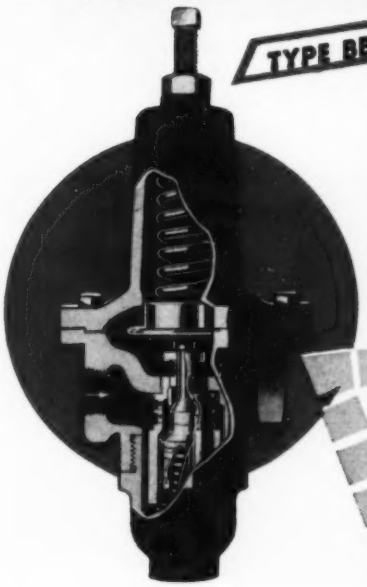
Factory: Emmaus, Pa.

Executive Offices: Times Building, Times Square, New York 18, N. Y.

FISHER

SELF-CONTAINED
GENERAL PURPOSE

PRESSURE REGULATORS

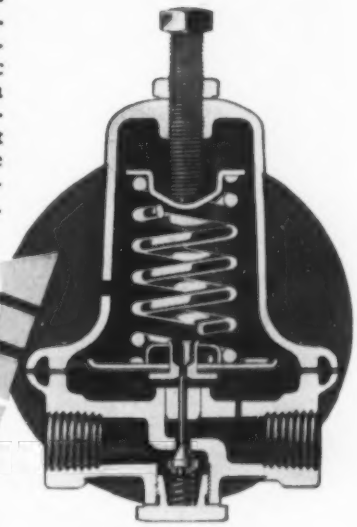


TYPE BB

A compact, entirely dependable regulator especially desirable for installations in limited space, on furnace humidifiers, steam tables, sterilizers, pneumatic equipment, and many others. Receives a varying or high pressure at inlet side, delivers a constant reduced pressure to outlet side. Suitable for air, water, non-corrosive gas or oil. For steam service only when furnished with metal valve seat and diaphragm.

PRESSURE RANGE: Reduced—10 to 150 PSI
Initial—Up to 250 PSI

Guaranteed Automatic Control



TYPE 67H

The Type 67H is a compact pressure reducing regulator that is ideal for use in small capacity commercial and industrial installations. It offers the following features:

1. Self-contained unit for ease of installation.
2. May be used for air, gas or liquids.
3. Delivers accurate stable control.
4. Provides absolute tight shut-off.
5. Available for inlet pressures up to 400 PSI and reduced pressures from 5 to 100 PSI.
6. Flows up to 165 gallons per hour of water at 250 PSI inlet.

TYPE 75

Unexcelled for cold water on domestic or industrial service. Protects plumbing fixtures, meters, etc., from high pressure surges in city water systems. Receives a varying or high pressure at the inlet side and delivers a constant reduced pressure to the outlet side. Not suitable for temperature over 150° F.

PRESSURE RANGE: Initial—Up to 200 PSI
Reduced—10 to 60 PSI

FISHER offers you the most versatile and complete line of "self-contained" regulators. They are small and compact and have unlimited application. Can be used whenever it is required to control a relatively small volume of air, gas, liquid or steam.

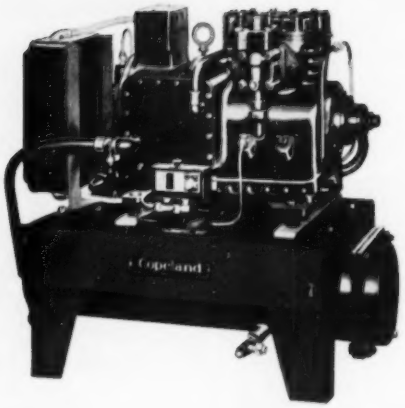
FISHER

FISHER GOVERNOR COMPANY • MARSHALLTOWN, IOWA

LEADS THE INDUSTRY IN RESEARCH
FOR BETTER PRESSURE CONTROL

COPELAMETIC

THE *Accessible* HERMETIC

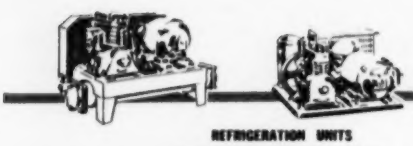


fits into any air conditioning plan

Cutaway of 7½ H.P. COPELAMETIC Motor-compressor

Whether it's a room air conditioner, a large package unit or a huge factory system, COPELAMETIC is your answer to the question "Which refrigeration unit shall I recommend for the air conditioning system?" COPELAMETIC has become the standard of comparison for dependability, ruggedness, compactness and long life. Your clients will appreciate the COPELAMETIC design which eliminates belts, seals and manual oiling . . . reasons for 9 out of 10 service calls. Better yet, they'll appreciate the practical feature of accessibility.

Air-cooled, remote COPELAMETICS are built from ¼ thru 3 HP. There are also water-cooled, remote units from ⅓ thru 7½ HP. Self-contained COPELAMETICS are available for all applications. Write for Condensed Catalog C-52.



REFRIGERATION UNITS (OPEN TYPE AND COPELAMETIC) WATER COOLERS

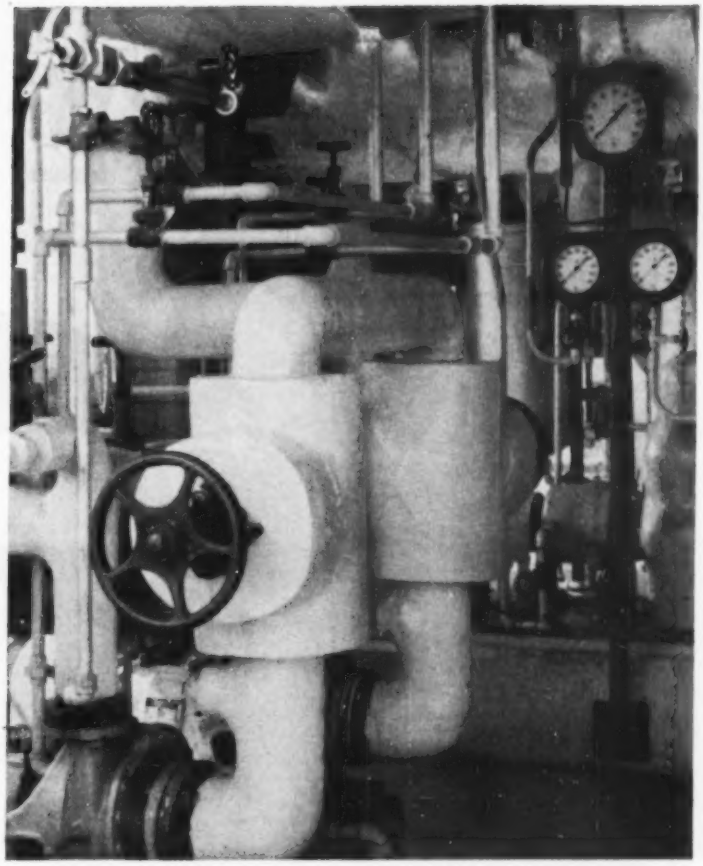
Copeland

DEPENDABLE *Electric* REFRIGERATION

COPELAND REFRIGERATION CORPORATION, SIDNEY, OHIO

Users say that Swift's Lagging Adhesive

SAVES TIME with a FAST SET



Swift's Lagging Adhesive helps you speed up your entire insulation operation because it sets faster and dries to a strong, continuous film. No waiting for the right humidity. Swift's Lagging Adhesive works efficiently under both dry and damp conditions. Here's why you can count on Swift's Lagging Adhesive to do your job more efficiently:

Safe! Does not support combustion . . . a synthetic resin emulsion, it's free of inflammable solvents and contains fire retardants.

Moisture-resistant . . . protects insulations against sogginess.

Mold-resistant . . . protects against mold and vermin attack.

Saves paint . . . an excellent undercoating for paint, it prevents penetration into lagging cloth . . . helps you go farther with less paint.

Easy to use . . . brushes on easily and quickly without dragging. Can be diluted with water if desired.

Tops as a cement and size in applying modern insulations

Call SWIFT first for ADHESIVES

This offer expires April 30, 1953

Swift & Company
Adhesive Products Department
Chicago 9, Illinois

Please send me your _____ gallon introductory trial shipment of Swift's Lagging Adhesive at the quantity price, to be tested for use in our operations. We understand, if not fully satisfactory, it may be returned for credit at your expense.

Name _____

Firm Name _____

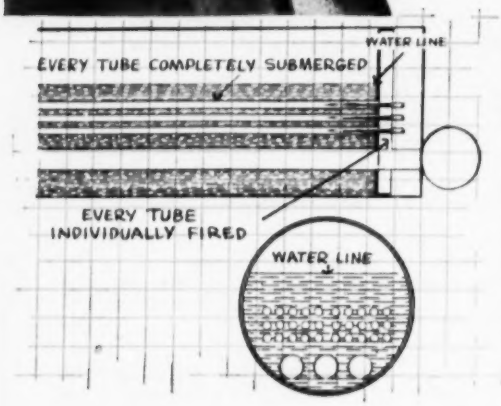
Address _____

City _____ *Zone* _____ *State* _____

All three know..

THAT NO OTHER STEAM BOILER IS LIKE A SELLERS IMMERSION STEAM BOILER!

Anyone familiar or experienced in steam boiler installations knows that a Sellers Immersion Steam Boiler is different because of its *REMARKABLE* and *SIMPLE DESIGN*. Each of the many long tubes are *individually gas fired*—and therefore *uniformly heated*. Furthermore, these tubes are completely submerged and nearer the water level—for 100% water backing and increased heating efficiency.



Many other features of this Sellers design combine to give you years of maximum efficiency at remarkably low operating costs. Twelve sizes available!

SEND FOR BULLETIN 1206 C-00
Your letterhead will bring you this tell all, dollar saving story on all 12 sizes!

Sellers ENGINEERING CO.

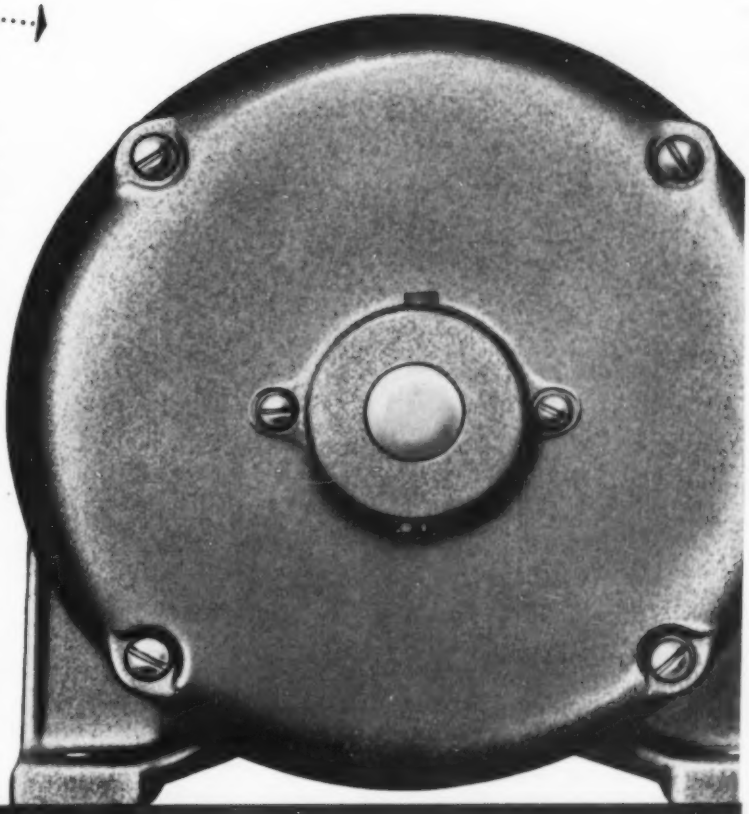
4876 N. CLARK STREET CHICAGO, ILL.

Blast Heaters • Immersion Automatic Water Heaters • Combustion Units • Industrial Gas Burners
Vertical Steam Boilers • Immersion Tank Heaters • Gas Combustion Equipment

DEPENDABILITY...
that builds dividends
Delco Motors

Delco integral motors are one item of manufacturing cost that does not come under the head of "variable." They are so consistently dependable in operation that they have a stabilizing effect on production costs—and on dividends.

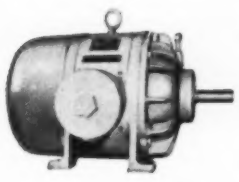
There are Delco motors for most applications—motors that will fit into **your** needs. A sales engineer from any one of the offices listed below will respond to your inquiry.



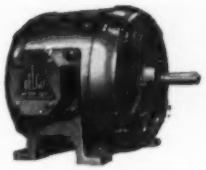
DELCO
DAYTON OHIO

DELCO PRODUCTS

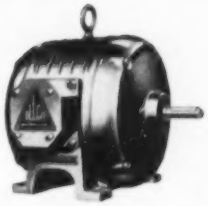
Division of General Motors Corporation
Dayton, Ohio



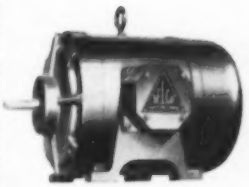
Explosion-Proof Motor



Open Ball-Bearing Motor



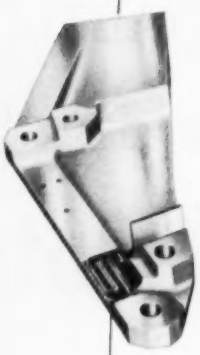
Totally Enclosed Motor



Totally Enclosed Fan-Cooled Motor

SALES OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Hartford • Philadelphia • St. Louis • San Francisco

where *Precision* counts

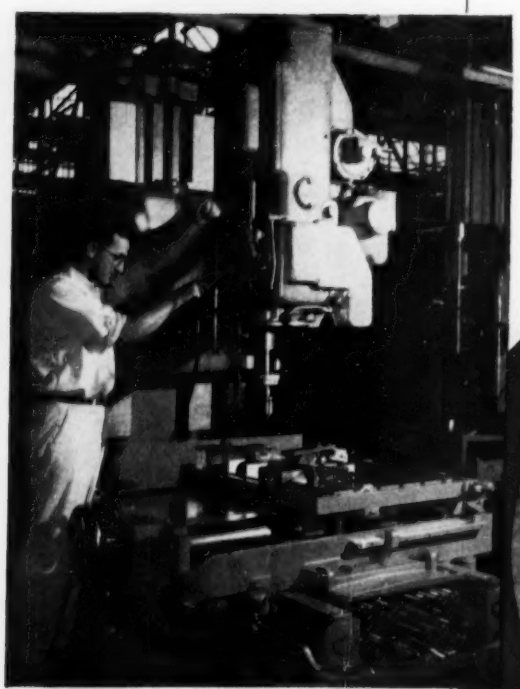


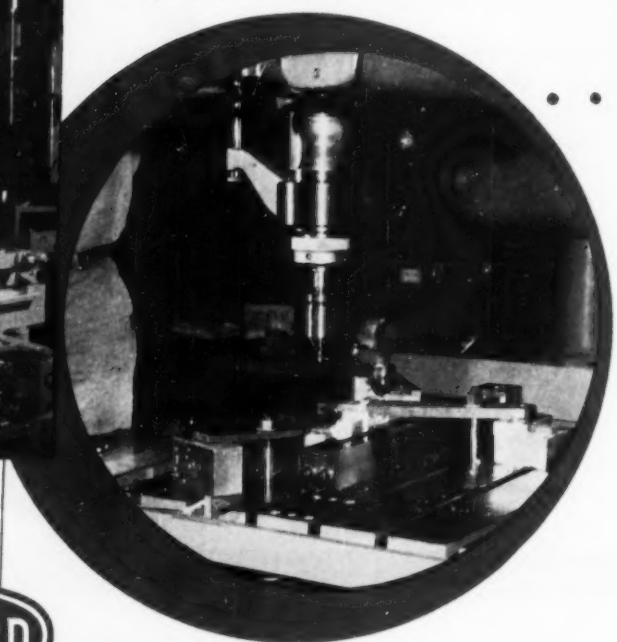
a natural combination hard to beat . . .

Bullard 30 x 20 Spacing Table installed on Cincinnati-Bickford fixed arm Precision Drilling Machine at Convair (Consolidated Vultee Aircraft Corporation, San Diego, California) is proving that these two units "pay-off" in elimination of jig cost, speeding-up production and accuracy in repetitive drilling on a variety of work.

A new job goes into immediate production with no lost time — no waiting for preparation of jigs.

Simple and comparatively fast change-over from one job to another minimizes production tie-ups.





Precision work materially reduces if not entirely eliminating spoilage and provides complete interchangeability of parts.

BULLARD SPACER

Ask for information on Precision Drilling without Jigs

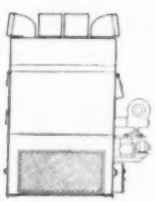
. . . THE BULLARD COMPANY . . . . .

BRIDGEPORT 2 • CONNECTICUT

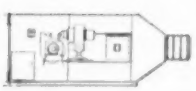
FOR ACCESSIBILITY

Here's a heater that was designed with the "easy maintenance" thought in mind. All accessories are mounted on the outside of the heater where it is a simple matter to service this unit. No drop cords, no crawling, no extra man hours and most important, no long interruption of heat that would force a possible shut-down.

No matter how you figure, Olson Heaters have built in all the money saving ideas that make for a long life, trouble-free heater. The initial cost is *low* and the installation is simple . . . the operation is completely automatic and constant attention can be eliminated.



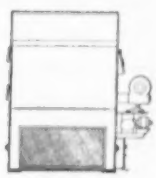
FLOOR MODEL



HORIZONTAL MODEL

INVERTED MODEL

RETURN AIR DUCT



DUCT TOP

THERE IS AN OLSON HEATER TO MEET ANY HEATING REQUIREMENT.

ARTHUR A. OLSON & COMPANY
BROAD ST. CANFIELD, OHIO

Mail this coupon for further information about sizes and ranges, detailed operation.

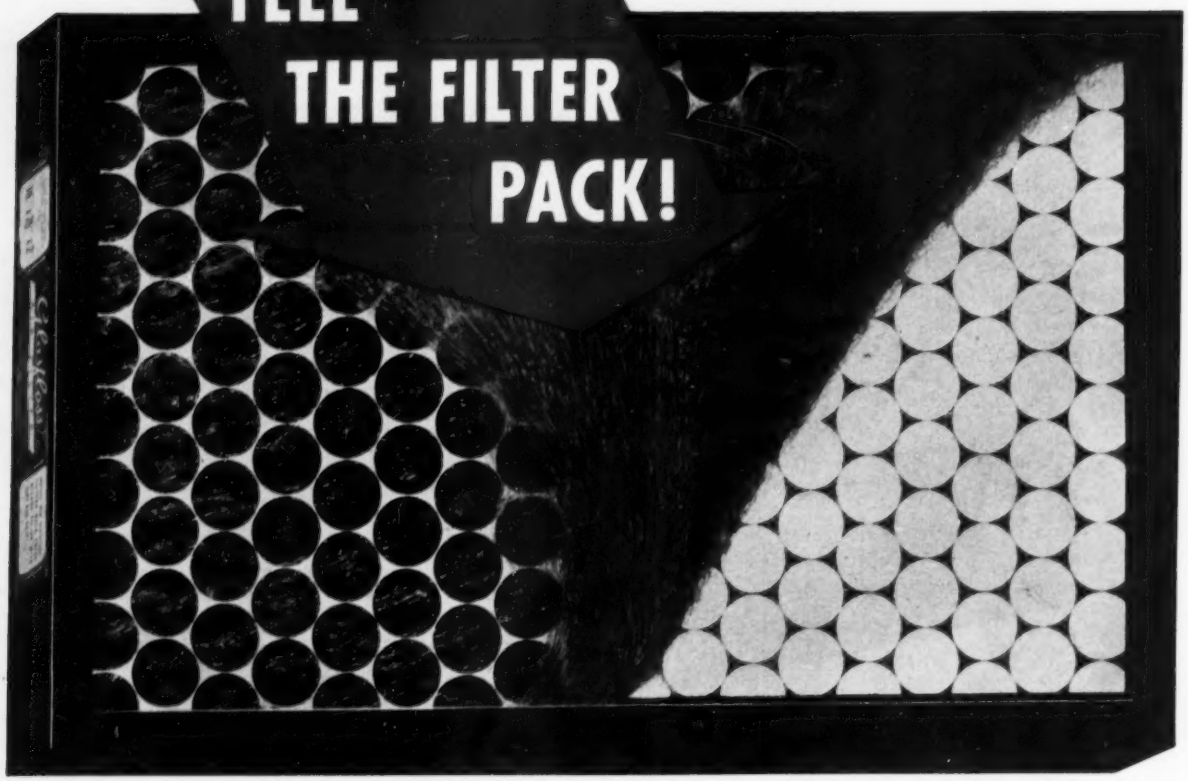
Representatives in principal cities.

ARTHUR A. OLSON & COMPANY
CANFIELD, OHIO
Please send me Olson Direct Fired Heater Catalog.

Name.....
Firm.....
Address.....
City.....State.....

When you Compare Air Filters . . .

FEEL THE FILTER PACK!



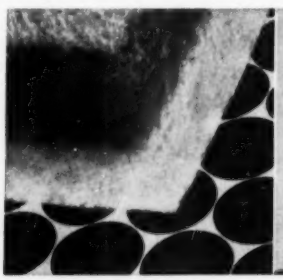
The soft, silky glass fibres are easy on the hands—and really stop Dust! The *magnified* view of the Glasfloss filter pack above shows why the long, fine curly fibres provide efficient filtering action. This fluffy, resilient mass provides an intricate maze of air passages with a greater surface area to catch and hold more dust throughout the entire pack. RESULT: Longer life, less changes, lower cost.

Glasfloss DISPOSABLE AIR FILTERS

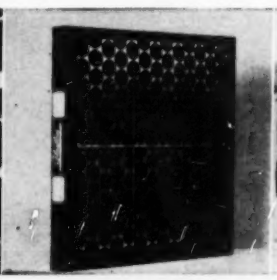
- Hold more dust at higher efficiency
- Less resistance to the passage of air
- Insure greater air capacities
- Easier to handle during installation and removal
- Tough and resilient
- Highly fire resistant
- Moisture-proof

Glasfloss
MAKES A COMPLETE LINE OF DISPOSABLE AIR FILTERS

Descriptive literature on request—
Address Dept. HPAC-3



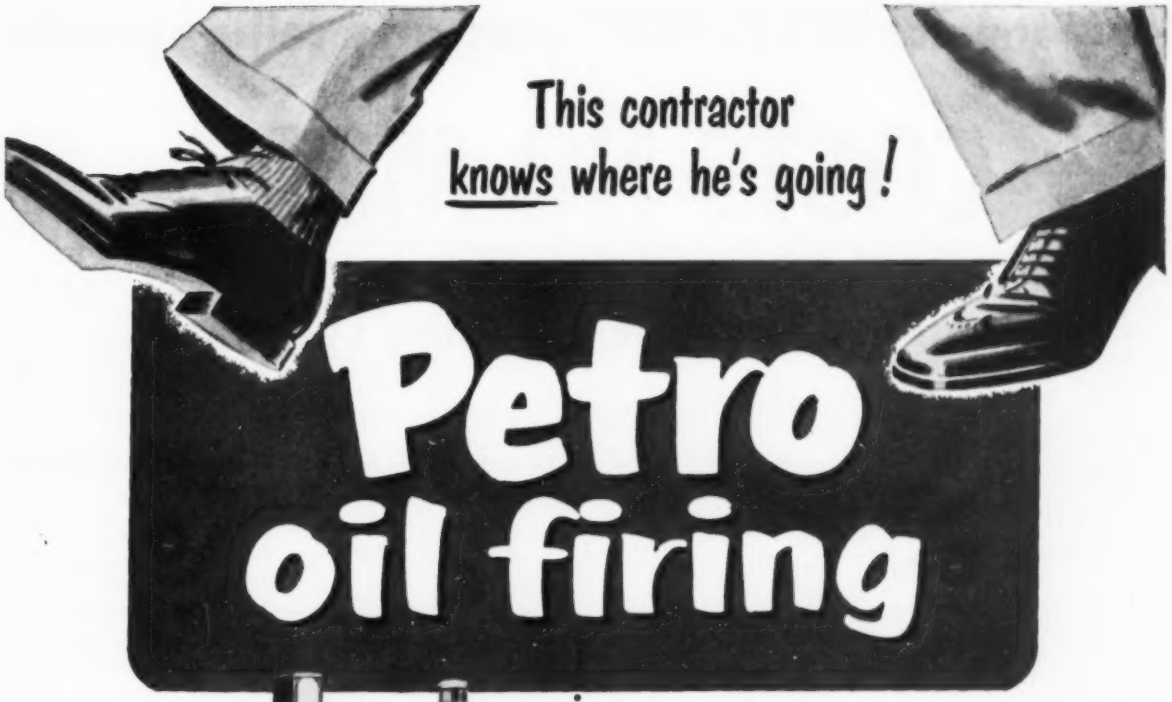
GLASFLOSS I-S
for heavy industrial use



GLASFLOSS STANDARD
the all-purpose filter

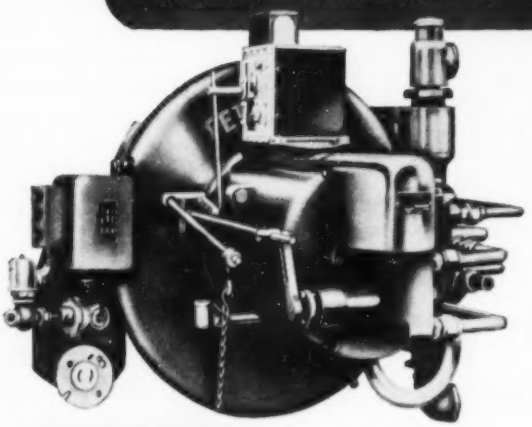
GLASFLOSS ROLL-PAK
for economical bulk use

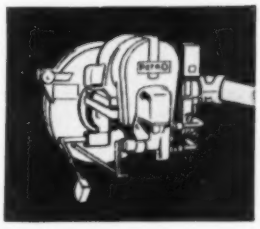
Glasfloss 155 EAST 44th STREET, NEW YORK 17, N. Y.



This contractor knows where he's going!

Petro oil firing





INDUSTRIAL OIL BURNERS

Rotary type. Burn low cost heavy fuel oil with complete reliability. Models for every industrial need. Capacities to 600 b.h.p.

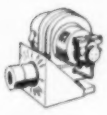
COMBINATION OIL-GAS

The perfect answer to fuel shortages or price advantages. Install in most any boiler. Switch fuels at a moment's notice.

Complete line for Home Heating

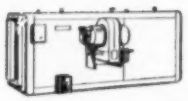
Furnaces and Boilers

Made in popular sizes to fit the heating needs of homes from 4 to 10 rooms. Extremely compact and attractive. Real fuel savers.



Conversion Units

Available for home and commercial use. Give unusual efficiency and fit in most any furnace or boiler. Capacities up to 20 gallons per hr.



Horizontal Furnace

Hang it or hide it—fits anywhere. Available in 5 models from 80,000 to 180,000 Btu's. Install in attic, basement, utility room or crawlway.

HEATING CONTRACTORS CHOOSE PETRO OIL FIRING BECAUSE THEY KNOW IT'S DEPENDABLE

CONFIDENCE — You *know* that a Petro will "do the job." You *know* that a Petro will deliver exceptional fuel economy. You know, and your customers know, that you have installed the best!

EASILY INSTALLED — Petro models are compact and well built. Sound and solid construction, easy access to oil and ignition lines and protected wire connections make Petro a favorite.

SIMPLE, DEPENDABLE PERFORMANCE — Petro oil burners are not complicated by "gadgets." They are simple, dependable units that demand no pampering service.

AUTOMATIC OPERATION WITH FLUCTUATING LOADS — Petro oil burners are almost instantly responsive and are therefore especially efficient for automatic modulated firing.

WRITE FOR COMPLETE INFORMATION

INDUSTRIAL-COMMERCIAL-RESIDENTIAL OIL BURNERS FOR EVERY FIRING NEED

PETRO

50 YEARS OF LEADERSHIP IN AUTOMATIC HEATING

3186 WEST 106th STREET • CLEVELAND 11, OHIO

New Modular MULTI-VENT® concealed ceiling panels

COSTS NO MORE

than ordinary air diffusing systems!

Yes! That is the big news in commercial, institutional, and industrial air conditioning for 1953.

Now you can specify this superior low velocity pressure displacement type of air distribution for metal pan ceilings at the same or *lower* cost than the high velocity injection type.

This is possible because the new MODULAR PANELS are so extremely simple and rapid to install. They can be assembled and installed in a few seconds by hand without the use of tools —a tremendous saving in labor cost!

Distributing air by Multi-Vent's gentle pressure displacement assures perfectly even air motion, and exceptional uniformity and control of room temperatures. The total absence of strong air streams or blow eliminates all the usual sources of draft complaints and permits complete freedom in locating panels and in relocating partitions.

Write today for detailed literature.

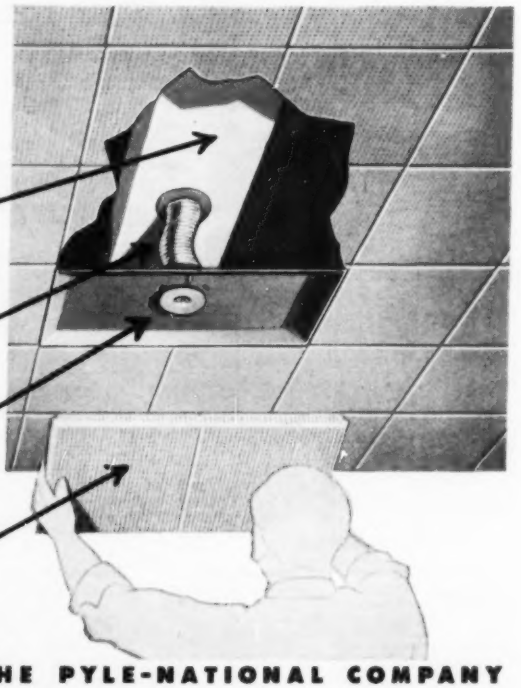
LABOR SAVING INSTALLATION FEATURES

■ **ADAPTABLE** . . . Duct can be shop built with 3-inch diameter openings at approximate panel locations. Duct work can be installed, flexible tubes with valve snapped in, and system balanced prior to and independent of ceiling erection. Panels can be located without regard to position of lighting fixtures and partitions.

■ **FLEXIBLE** . . . compressible tubing permits wide latitude in alignment, thus radically reduces installation cost by eliminating all need for time consuming close fitting sheet metal work.

■ **ADJUSTABLE** . . . orifice valve can be simply set by wing nut for varied amount of air delivery. Individual panel adjustments do not disturb the overall balance of the system.

■ **COMPLETELY CONCEALED** . . . ANY STANDARD PERFORATED 12" x 24" ACOUSTICAL METAL CEILING PAN (supplied by the ceiling contractor) functions as the distribution plate for the MODULAR MULTI-VENT PANEL. The panel simply replaces the acoustical pad and nests snugly in the pan which snaps into ceiling tee runner, unhampered. Ceiling face is undisturbed.

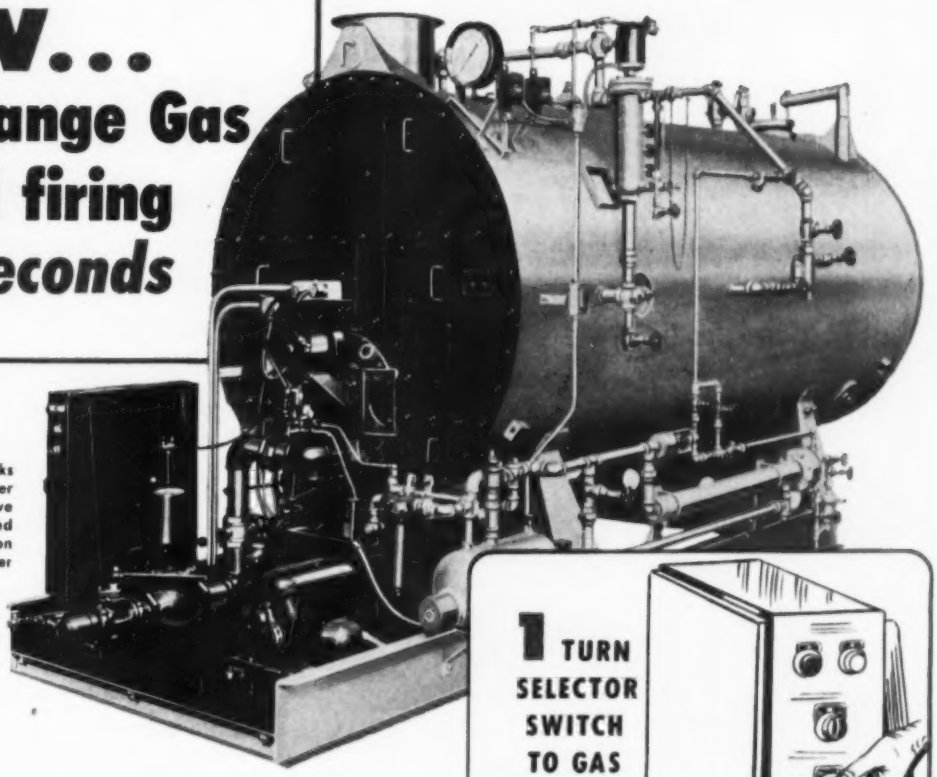


MULTI-VENT DIVISION **THE PYLE-NATIONAL COMPANY**

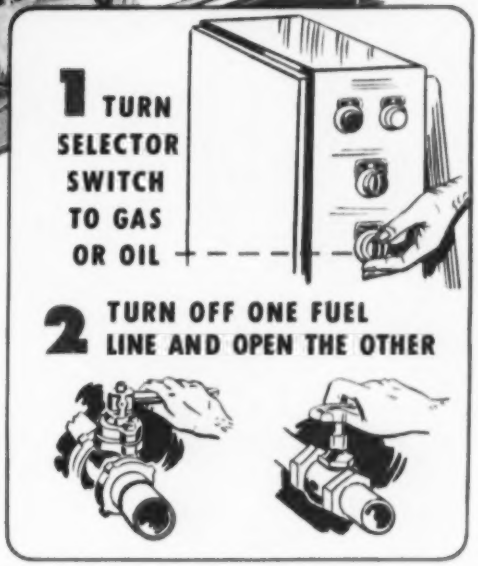
Sales and Engineering Representatives in Principal Cities of United States and Canada

1373 North Kostner Ave. Chicago 51, Illinois

NOW... interchange Gas and Oil firing in *10 seconds*



Modern Cleaver-Brooks Model LR Steam Boiler Equipped with Exclusive Cleaver-Brooks "10-second conversion" Combination GAS and/or OIL Burner



TWO, simple motions eliminate time-consuming change-over

Now you can use oil or gas at the flick of a switch! This exclusive new Cleaver-Brooks development permits changeover from oil to gas or vice versa in only 10 seconds.

That's because the Cleaver-Brooks Combination Gas and/or Oil Fired Boiler operates on gas *with the oil burner in place.* Simply flipping a selector switch on the control panel to either gas *or* oil sets the proper circuit in action. Turning the convenient fuel supply valves completes the entire changeover — and in 10 seconds or less!

To gas users in all parts of the country — and in particular areas where local requirements demand immediate changeover — this exceptional fuel flexibility can be an important factor in determining your overall operating economy.

Ten-second conversion, like 4-pass construction, self-contained design, guaranteed 80% efficiency, is another "plus" feature pioneered by Cleaver-Brooks. It demonstrates Cleaver-Brooks' continuing effort to bring steam users even greater flexibility and reduced operating costs.

If you are considering simplifying your present boiler plant, remember Cleaver-Brooks Combination GAS and/or OIL Fired Boilers. Sizes 15 to 500 h.p. — 15 to 250 p.s.i. Write for complete facts.

Cleaver-Brooks

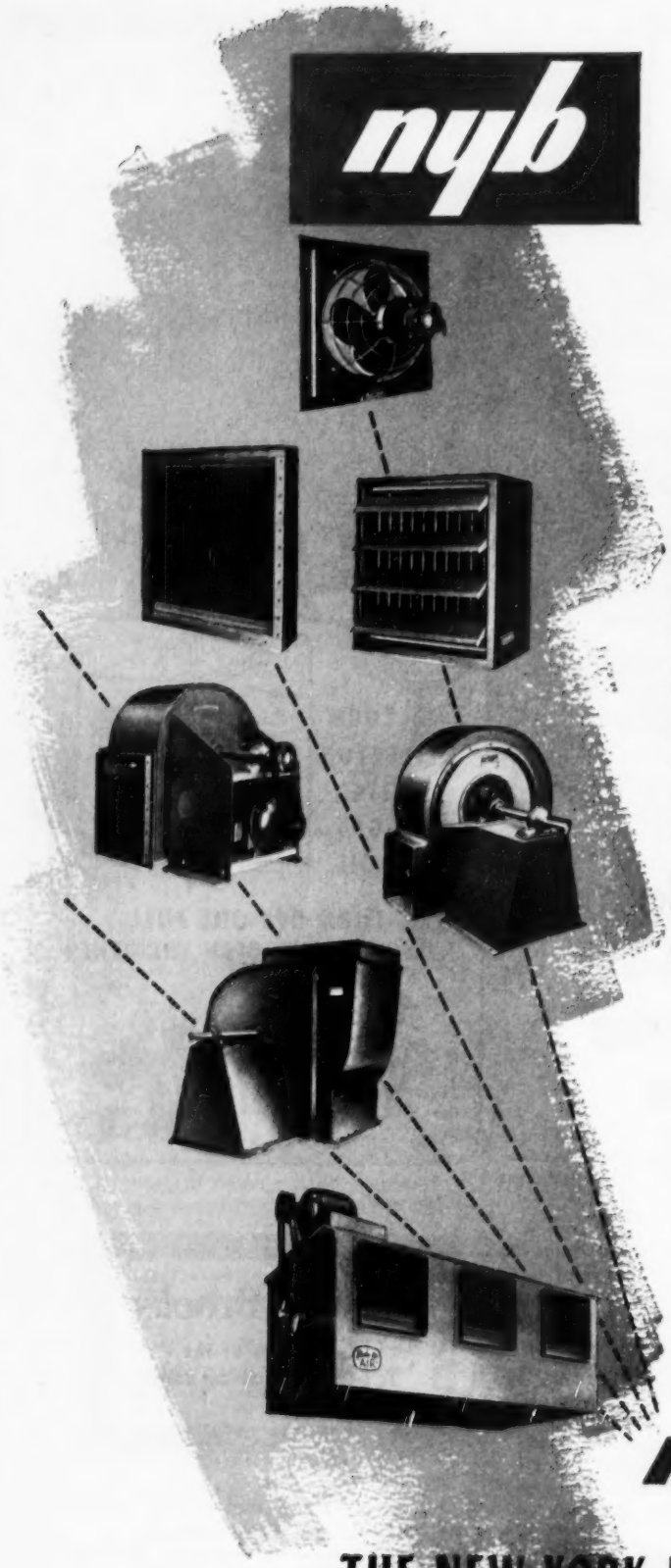
Originators of the Self-Contained Steam Boiler

CLEAVER-BROOKS COMPANY

Dept. C, 313 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.

Cable Address: Clebro-Milwaukeewis

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners



nyb

Announces

TWO NEW BELTED JUNIOR FANS No. 76 and No. 91

QUIET OPERATING
SLOW SPEED WHEEL
ADJUSTABLE AIR DELIVERY

Capacities from 400 to 1400 cfm

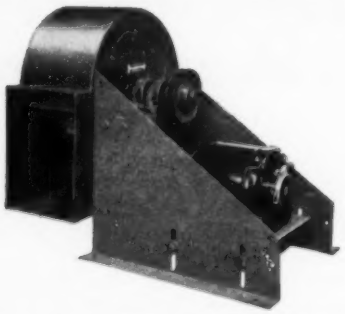
Developed to meet popular demand for a small, adjustable speed V-belt fan, which is quiet in operation and where fan speed can be adjusted in the field.

CAST ALUMINUM SLOW SPEED WHEEL is ideal to meet requirements of small ventilating problems such as exhaust from private offices, washrooms, laboratories, where quiet operation is demanded and precise quantities of air are to be handled. In order to use the Slow Speed wheel for this service, belt driven units are necessary.

V-BELT DRIVES have adjustable motor sheave giving speed adjustments of 30% to 50% depending upon the motor selected.

RUGGED CONSTRUCTION • Realizing that quiet fan operation requires sturdy construction, the same type all-welded steel housing is used as in the larger ***nyb*** ventilating fans.

Write for Bulletin 530



FANS • BLOWERS • UNIT HEATERS • MAKE-UP AIR UNITS • HEAVY DUTY HEAT SURFACE

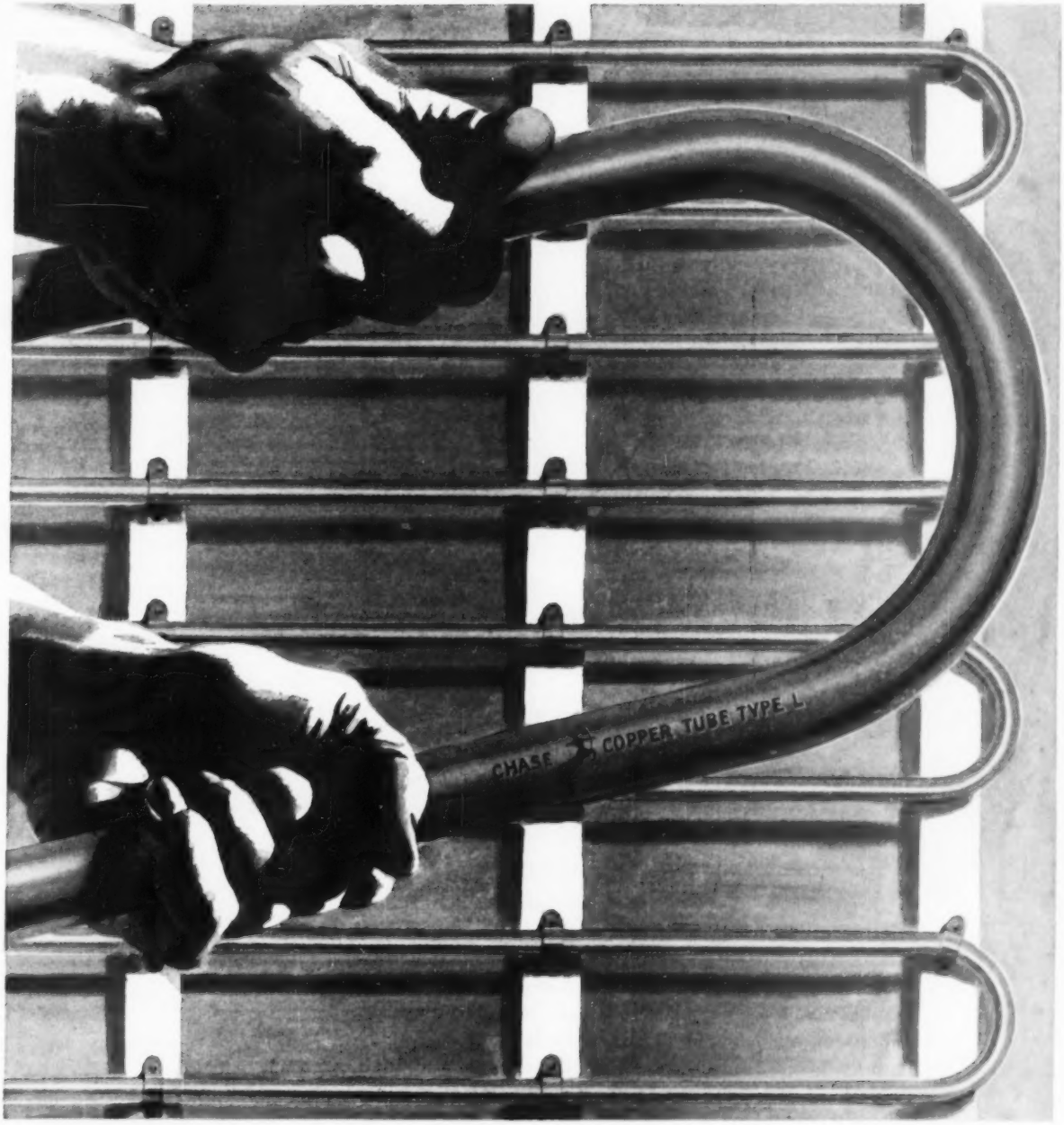
nyb

SEE OUR CATALOG IN SWEET'S

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 32nd STREET and SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA



FOR RADIANT HEATING *choose easy-to-bend* CHASE® COPPER TUBE

Fewer joints are needed when you use long lengths of easy-to-bend Chase Copper Tube. It's lightweight and comes in all sizes. Together with Chase Solder-Joint fittings it makes perfect radiant heating installations for walls, floors and ceilings. And you just can't beat Chase Copper Tube for quality, thermal conductivity and corrosion resistance. Write today for FREE 50-page book on Radiant Panel Heating.

Chase® BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany †	Cleveland	Kansas City, Mo.	New York	San Francisco
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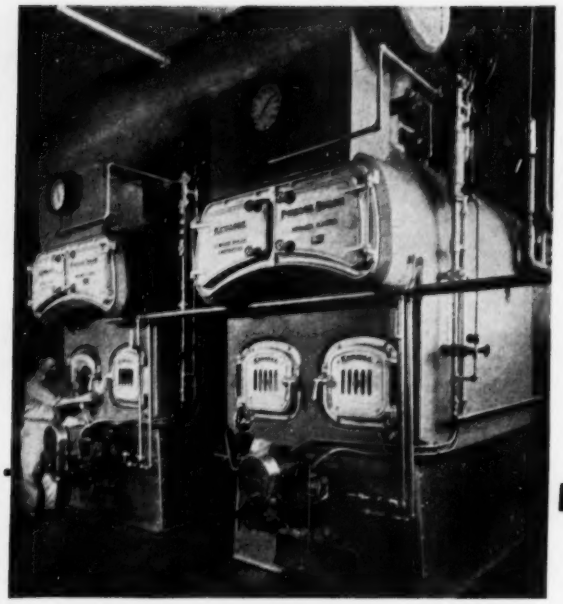
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston †	Newark	Rochester †	(† sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	



MORE ENGINEERING
MORE MATERIAL
MORE EXPERIENCE

MAKE THE DIFFERENCE

KEWANEE

HEAVY-DUTY STEEL BOILERS

There is *more put into* Kewanee Boilers so their owners *get more* from them. There is more engineering, more experience, more steel and labor . . . the very things which insure longer life, unfailing operation and more heat or power from each fuel dollar.

The choice of Kewanee for the Stevens Memorial Hospital . . . selected as the "Hospital of the Month" by Modern Hospital Magazine . . . is in keeping with the trend of specifying Kewanee when dependable, economical heat or power is essential. And, it is significant that this building, erected with the finest materials and equipment throughout, was found in a U. S. Public Health Service study to have the *lowest construction cost per bed* of the 45 hospitals receiving federal aid during the period.

KEWANEE-ROSS CORPORATION
Division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS

STEVENS COUNTY MEMORIAL HOSPITAL
Morris, Minnesota
MAGNEY, TUSLER and SETTER
Architects and Engineers
2 Heavy-Duty Kewanee Boilers installed by
EGAN & SONS
Heating Contractors

KEWANEE BOILERS

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

This power roof ventilator runs C-O-O-L...even on hot roofs

Most successful ventilator in ILG's 47-year history!

• ILG can point to dozens of pioneering developments since 1906 for the ventilating and heating industries. But none of these prior contributions can approach the immediate acceptance and continuously increasing use of these new Centrifugal-type Power Roof Ventilators. In a matter of months these new units have found their way into the specifications and onto the roofs of important buildings throughout the nation. Today you will see them on hospitals, schools, industrial and governmental buildings everywhere. They answer the demand for "package" ventilators, easily installed, complete with desirable air-handling features, and with all parts quickly accessible. If you do not have latest data on these powerful roof ventilators for use on vertical flues or duct systems, take action today. Call our nearby Branch Office (consult classified directory) or send coupon now.

ILG knows ventilation!

Free! New engineering data bulletin No. 1902 gives you the complete story—features, sizes, capacities, dimensions. Send coupon now!

☐ Send free bulletin No. 1902

Firm Name_____

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Address_____

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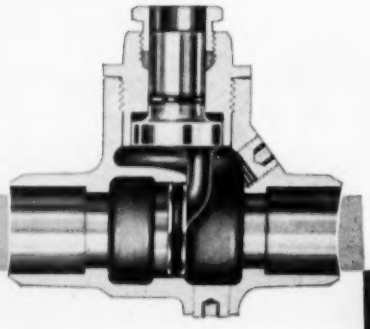
O-B EQUATEMP®

. . . one valve for the complete balancing job

Check These Features

- Easy Regulation
- Complete Shutoff Possible
- Top and Bottom Drain Plugs
- Thermometer Well
- Simple Disassembly
- Well Installation Possible
- Double Protection Against Stem Leakage



The Equatemp balancing valve controls water flow in heating or cooling systems *and* acts as a positive, leaktight shut-off. Since it both balances and shuts off, Equatemp does a job that formerly required two or more valves and fittings.

The shutoff feature is a definite convenience and time-saver for venting or bleeding, draining, or repairing lines. It saves the trouble of shutting off the entire system.

The savings and convenience continue through the life of the valve. Two drain plugs permit venting or draining in any position - - upright or inverted. An easy-to-use Allen-type wrench is furnished for regulating.

Equatemp features rubber "O" rings on both the butterfly type disc and the stem. Conventional packing under nut at top provides *additional* protection against stem leakage.

Equatemps can be used on lines carrying water up to 212 degrees F., and up to 100 pounds gage pressure. For additional information, call your local O-B distributor or write to Ohio Brass, Mansfield, Ohio.

Ohio Brass

MANSFIELD (B) OHIO, U.S.A.

TYPES AND SIZES

The No. 37 solder-type Equatemp for tubing installations can be furnished in $^{3}/_{8}$, $^{1}/_{2}$ and $^{3}/_{4}$-inch sizes. The No. 38 Equatemp, with threaded pipe ends, is available in $^{1}/_{2}$, $^{3}/_{4}$, 1, $1^{1}/_{4}$ and $1^{1}/_{2}$-inch sizes.

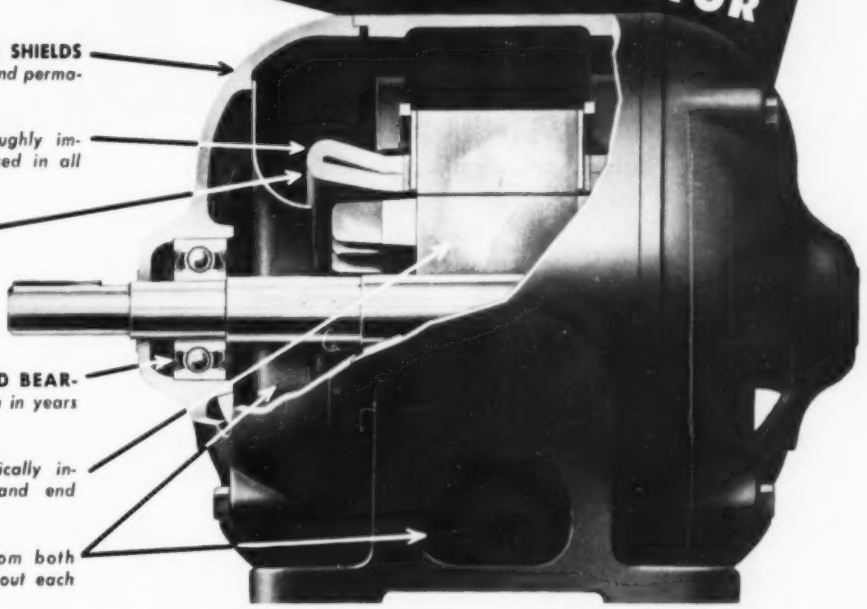
TYPICAL APPLICATIONS IN HEATING AND AIR CONDITIONING

Floor, Ceiling, Baseboard, Panel, Convector, Unit Air Conditioners, Unit Heaters

4375-V

Reliable?— well, check these features in the...

ELLIOTT SQUIRREL-CAGE INDUCTION MOTOR



RIGID GRAY IRON END SHIELDS *for solid bearing support and permanent alignment.*

VINYLASTIC WIRE *thoroughly impregnated and baked, used in all stators.*

CORDED END TURNS *for strength and permanence and phase-to-phase insulation to give further assurance of long life.*

SEALED PRELUBRICATED BEARINGS *needing no attention in years of service.*

ALUCAST ROTORS *practically indestructible — bars, fans and end rings are one solid piece.*

DUAL VENTILATION *from both ends of rotor, discharged out each side of the frame.*

Isn't this what you want in a good general-purpose motor —one that will require no babying nor special attention while in service on machine tool, process apparatus, fan, blower or pump? Here is sound dependability based upon solidly established past performance in applications of all kinds. Here is a motor that has passed every service test, thousands of them, tough as they come.

Another thing—this motor with all its rugged qualities, is available in all standard mountings—horizontal C face mounting, frame with feet — vertical flange mounting, with built-in C-W brake, in open drip-proof or splash-proof enclosure. In NEMA frames 203 through 505.

Put this Elliott Crocker-Wheeler motor wherever you want it, and say good-bye to motor troubles.

For full data on this and other Elliott C-W motors, contact your local Elliott field engineer or write Elliott Company, Jeannette, Pa.

RIGHT FOR AIR CONDITIONING

Here is one of 95 of these C-W motors in a new air-conditioned skyscraper. This one of 15 hp, drives a big return fan.

W3-2

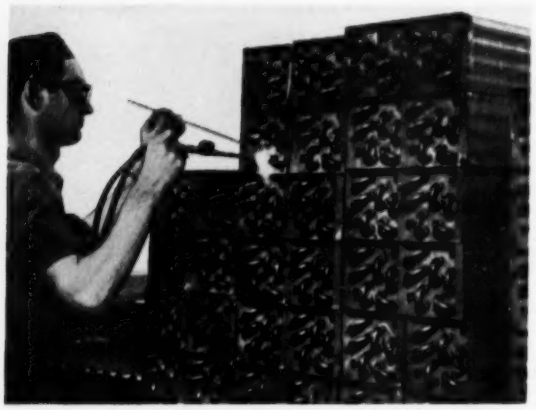
ELLIOTT Company

CROCKER-WHEELER DIVISION

It's an old custom

BRAZING PIPE AND TUBING WITH EASY-FLO AND SIL-FOS

And the reason it's common practice in the automotive, refrigeration, heating, piping, air conditioning and other industries, to join pipe and tubing with EASY-FLO and SIL-FOS, is simply this — these low-temperature silver brazing alloys just naturally and consistently make the *strong, ductile, permanently leak-tight joints* pipe and tubing applications demand — and they do it fast and at surprisingly low cost.

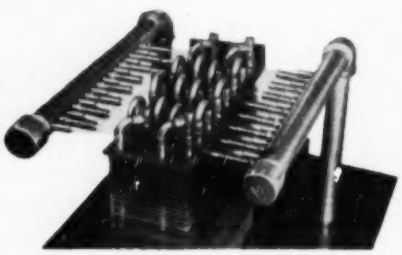


EASY-FLO and SIL-FOS give you the same fast action and reliable results whether you apply them by hand, or by preplacing and heating automatically as below where 32 joints are gas-air brazed in 45 seconds.

BULLETIN 20
tells why and how

This 24-page bulletin makes crystal-clear why strong, leak-tight joints and fast, low-cost production are *inherent* in EASY-FLO and SIL-FOS brazing — and how to put them to work. Write for a copy today.

EXPERT AID
in applying these alloys to your work is always at your call — without obligation. Ask for a Field Engineer.



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ORIGINATORS OF EASY-FLO & SIL-FOS

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General Offices: 82 Fulton St., New York 38, N. Y.

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FOR 90° THREADED CONNECTIONS IN ALL HIGH AND LOW PRESSURE PIPING SYSTEMS . . .

specify and use

BONNEY THREDOLETS

YOU DERIVE THE FOLLOWING ADVANTAGES:

1. ACCELERATED FABRICATION—

with ThredOlets no coupling preparation is necessary—you obtain the most economical type of construction.

2. NEAT AND UNIFORM APPEARANCE—

ThredOlets minimize variations caused by human element—you attain the best engineered type of construction.

3. IMPROVED FLOW—

ThredOlets provide a funnelled inlet—you achieve better performance and better piping system design.

4. DIMENSIONAL STANDARDIZATION—

with each ThredOlet installation, you have constant control of the critical center-of-run-pipe to face-of-outlet dimension.

The Bonney WeldOlet Welding Fittings Catalog, No. W-3, provides complete engineering and dimensional data.
Write for your free copy.

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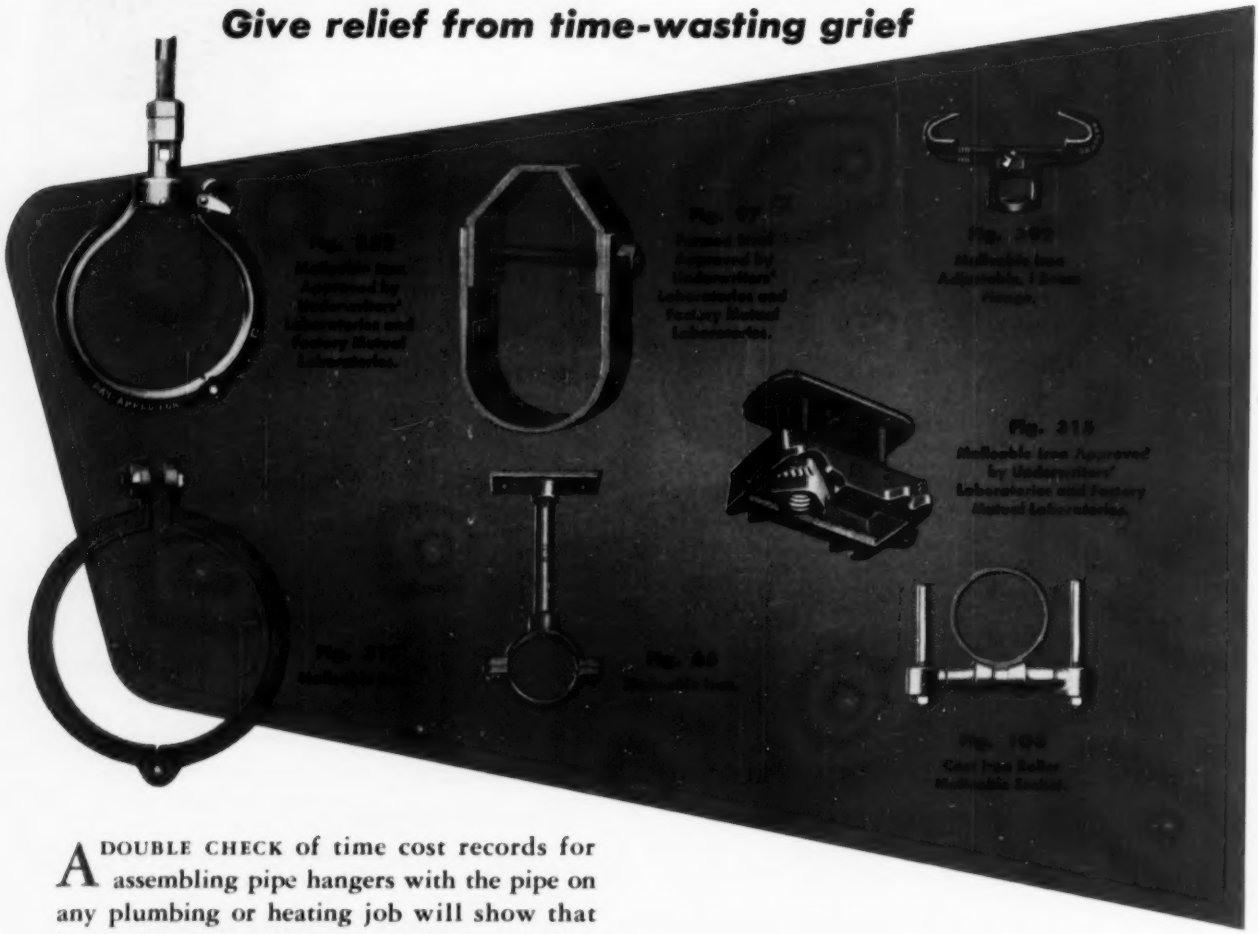
GRABLER

SQUARE "GEE" PIPE HANGERS

Give relief from time-wasting grief



A DOUBLE CHECK of time cost records for assembling pipe hangers with the pipe on any plumbing or heating job will show that Square "Gee" Pipe Hangers are time-cost saving tools. They are designed and fabricated to comply with modern engineering and construction practices. Grabler Pipe Hanger Catalog J illustrates and lists many types. Ask your wholesaler for Grabler Square "Gee" Pipe Hangers.

THE **GRABLER** MANUFACTURING COMPANY
6565 Broadway, Cleveland 5, Ohio

GRABLER

THE SQUARE "GEE" LINE INCLUDES:

Malleable Fittings, AAR Fittings, Unions, Rail Fittings, Cast Iron Steam Fittings, Cast Iron Drainage Fittings, Patented Drainage Fittings, Copper Tube Solder-Joint Fittings, Cast Brass Solder-Joint Drainage Fittings, Steel Pipe Nipples, Hangers.

WAREHOUSES: New York • Philadelphia • Atlanta • Pittsburgh • New Orleans • Dallas • Chicago • St. Louis • Minneapolis • Denver • San Francisco • Los Angeles

If You Demand Efficient Performance You'll Buy . . .

GALLAHER Air-Vans®

No other power roof exhauster can develop 4" Static pressures. No other power roof exhauster has built in *scroll effect* design that makes high performance possible.

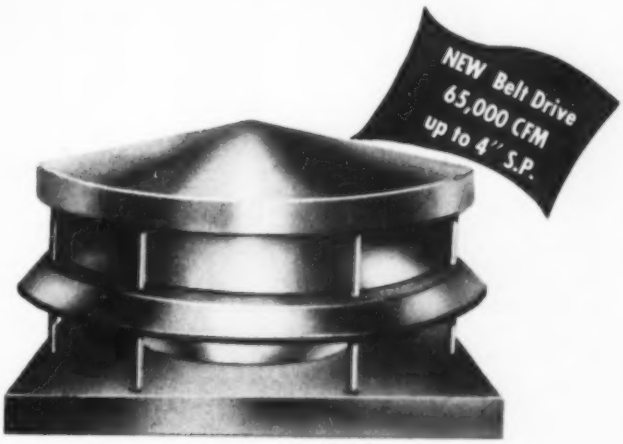
These are not idle claims. Firms that buy Air-Vans know they can depend on the above statement, because The Gallaher Company has always backed its performance with a continuous program of basic research in the engineering principals of air movement.

This research has led to new efficiencies and patented exclusive features. It has meant certified ratings of the whole unit not just fan wheel. You can be sure of performance because it has been physically tested by an independent laboratory. These ratings are not calculated guesses or interpolations which can be grossly inaccurate.

Research led to the development of exclusive built-in *scroll effect*. And Gallaher research has shown that performance against even normal static pressures is impossible without this feature.

Research led to the air seal-off principal that means real protection against fumes entering the motor housing. Gallaher units have removed ether and air without static explosion proof motors.

To this add heavy construction and weatherproof design. Add low silhouette and the economies possible in power roof exhausters installation. Add them all and *demand efficiency*. You'll end up buying Air-Vans.



Pat. 2526290, 2188741

The GALLAHER Company

4108 Dodge Street • Omaha, Nebraska

GENTLEMEN:

Send me full information on Gallaher Power Roof Exhausters.

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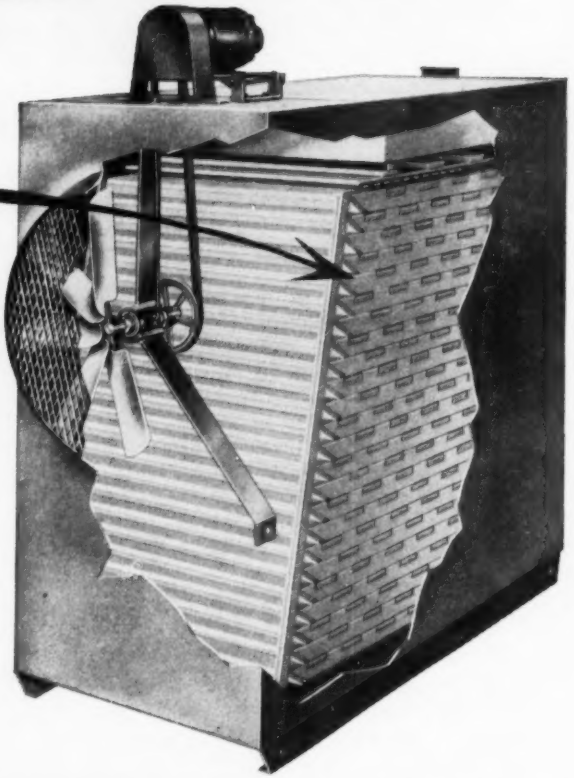
ADDRESS _____

CITY _____ STATE _____

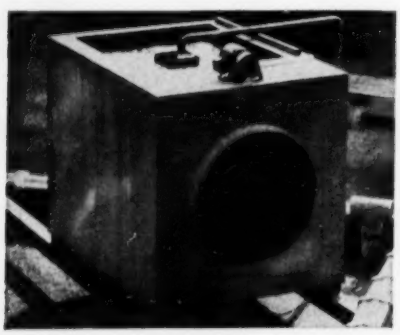
HALSTEAD & MITCHELL COOLING TOWERS

20-Year Guarantee!

On the Wetted Deck Surface of Koppers Pressure-Treated Wood



Here's the industry's greatest cooling tower value . . . "built like a battleship" for 20 years of foolproof performance. Halstead & Mitchell's pioneering in exclusive use of Koppers pressure-treated wood in the wetted deck surface makes possible the unprecedented 20-year guarantee against rotting, and provides the industry's most effective deterrent against fungi growth. Economical, lastworthy . . . the special H & M design for water distribution eliminates, thru the use of an efficient gravity-type distributing pan, extra pumping head required on spray type towers, also cuts down windage losses due to atomizing of water. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service. Easily accessible for cleaning through inlet on back of towers in all sizes.



MORE EFFICIENT IN ANY INSTALLATION

H&M # CT-4000 Induced-Draft Cooling Tower supplying the condensing water for 20 HP and 10 HP water-cooled condensing units in 3-story jewelry storeroom air conditioning. Note open-type distributing pan. This installation also has remote water basin in basement for year-round operation.

2 TONS to 100 TONS

A cooling tower for all applications, from 2 to 100-ton capacities—made by Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers.

AT LEADING WHOLESALERS EVERYWHERE

Write for descriptive bulletin and information on engineering helps.

HOUSING—10 gage (1/8"+) sheet-steel case with 3 coats Bitumastic lining. Electrically welded cabinet. All bolts used are Everdur for ease of disassembly after years of service.

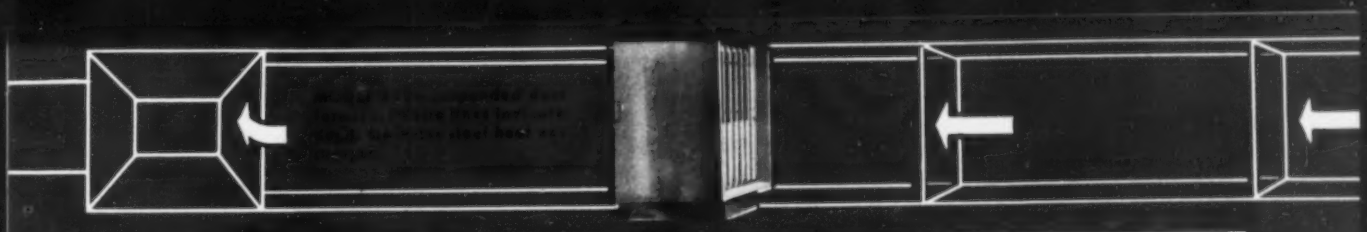
WATER DISTRIBUTION—Gravity type distributing pan eliminates extra pumping head, cuts down windage losses, due to atomizing water.

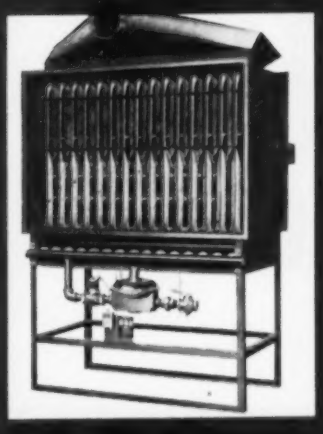
FAN AND DRIVE—Quiet-operating stainless steel 8-bladed fan, stainless steel shaft, chrome-dipped rust-proofed pulleys. Cast iron bearing supports. Adjustable belt tension.

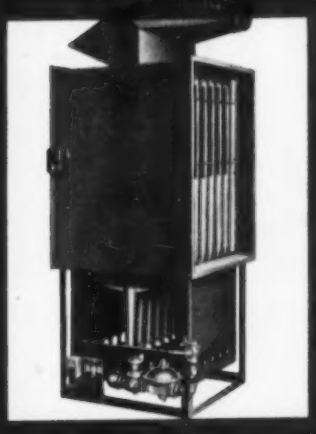
HM

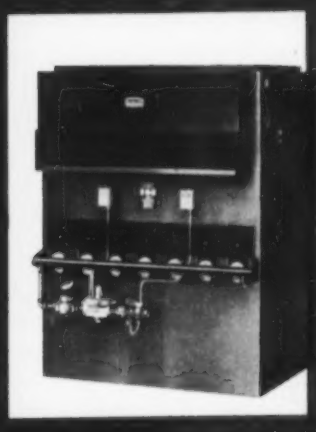
Halstead & Mitchell

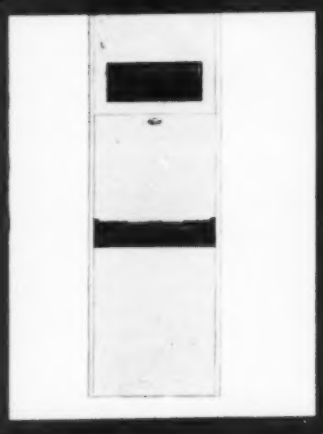
OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.

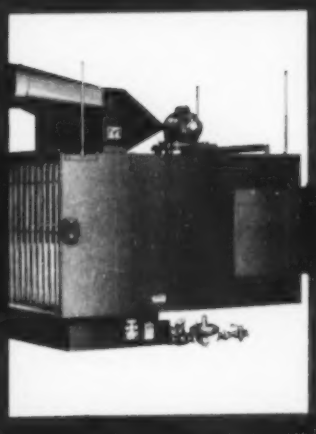






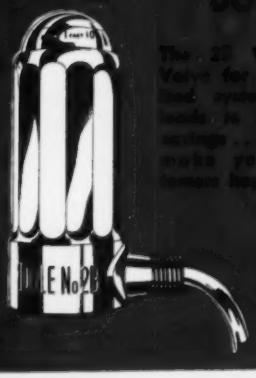


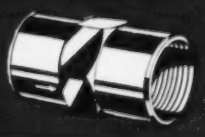




HAYES FURNACES

HAYES
GAS FURNACES





all along the line...

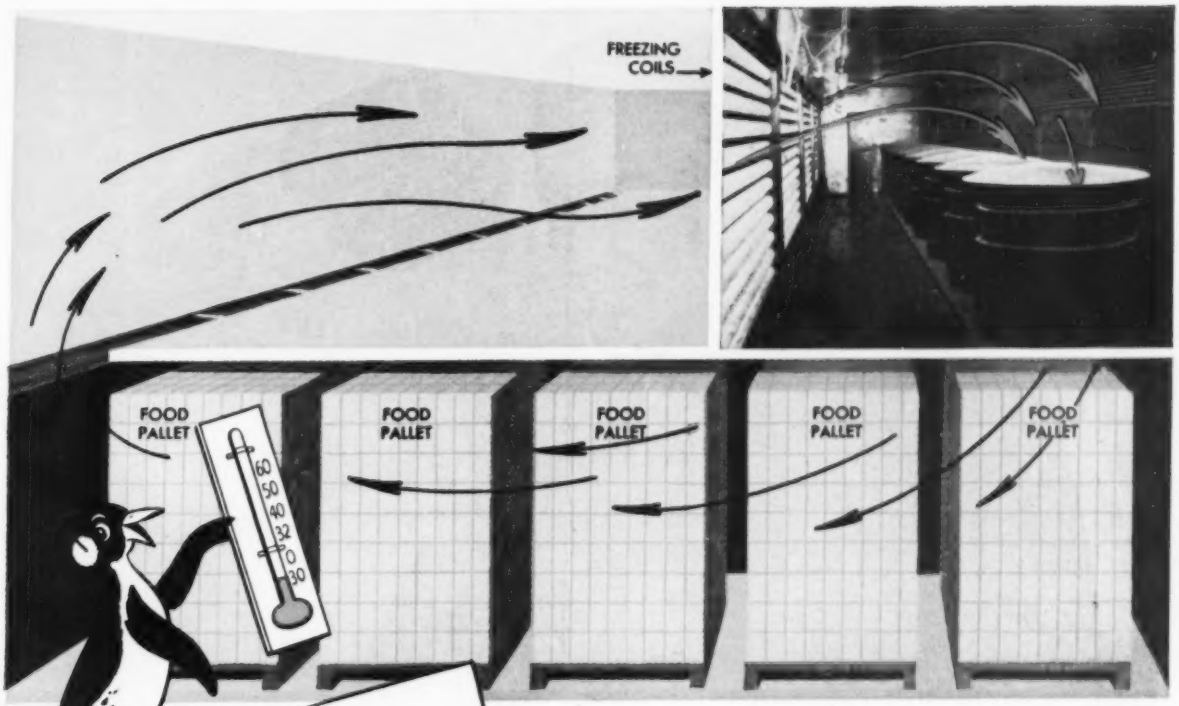
"CONTROL WITH DOLE"

means profits for you—
satisfaction for your
customers

Control with Dole TRADE MARK

DOLE

THE DOLE VALVE COMPANY
1933 Carroll Ave., Chicago 12, Ill.
Representatives in Principal Cities



JOY AXIVANE® FANS HANDLE SEVERE QUICK-FREEZE JOB

A West Coast quick-freezing plant boasts an effective operation that utilizes 24 Joy 7½ HP Series 1000 Axivane Fans, installed in two groups of 12 each.

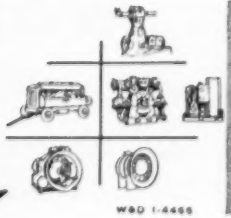
Note the illustration above. The upper floor contains freezing coils and a row of 12 fans. The floor below is partitioned into narrow freezing tunnels, each served independently by a single Joy fan.

As air passes through the freezing coils, it is cooled to between —30° and —35°. This sub-zero air is propelled down and through the tunnels below, which contain pallets of meat, vegetables, fruit, etc. to be quick-frozen. After passing over the food, the air is again cooled and circulated. At full plant load, each 12-fan battery handles 242,000 CFM of air.

The relatively quiet operation, light weight, compactness and low power consumption of Joy Axivane Fans—due to the unmatched efficiency of their vaneaxial design—have proved *real* advantages on this job. Their in-line construction also saves space, since each fan can be mounted right in its short, vertical duct. In addition, extreme flexibility of operation is made possible by the adjustable blades, a standard Joy feature. ● Let us help you to get best results on your fan problems. ***Joy Manufacturing Company, Oliver Bldg., Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Left: Looking up from the quick-freeze room below a Joy Axivane Fan. Note the compact, economical use of space and the simple mounting.

Consult a Joy Engineer



for Vaneaxial Fans . . . Compressors, Vacuum Pumps and Boosters . . . Oxygen Generators

WBD 1-4466

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

THE PICK OF THE PACKERS

Out where the West *ends* . . . many of the great meat packers use Worthington *refrigeration* machinery.

And all over the country, many famous *restaurants*—Toffenetti's in Times Square, Silver Fox Restaurant in Washington, The Century Room, Dallas—use Worthington *air conditioning machinery.*

When you specify "Worthington", you specify the air conditioning and refrigeration equipment that's used by the "first" names in every field.

No other manufacturer makes *so complete* a line. A Worthington system is all Worthington-*made*—not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility.

Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.

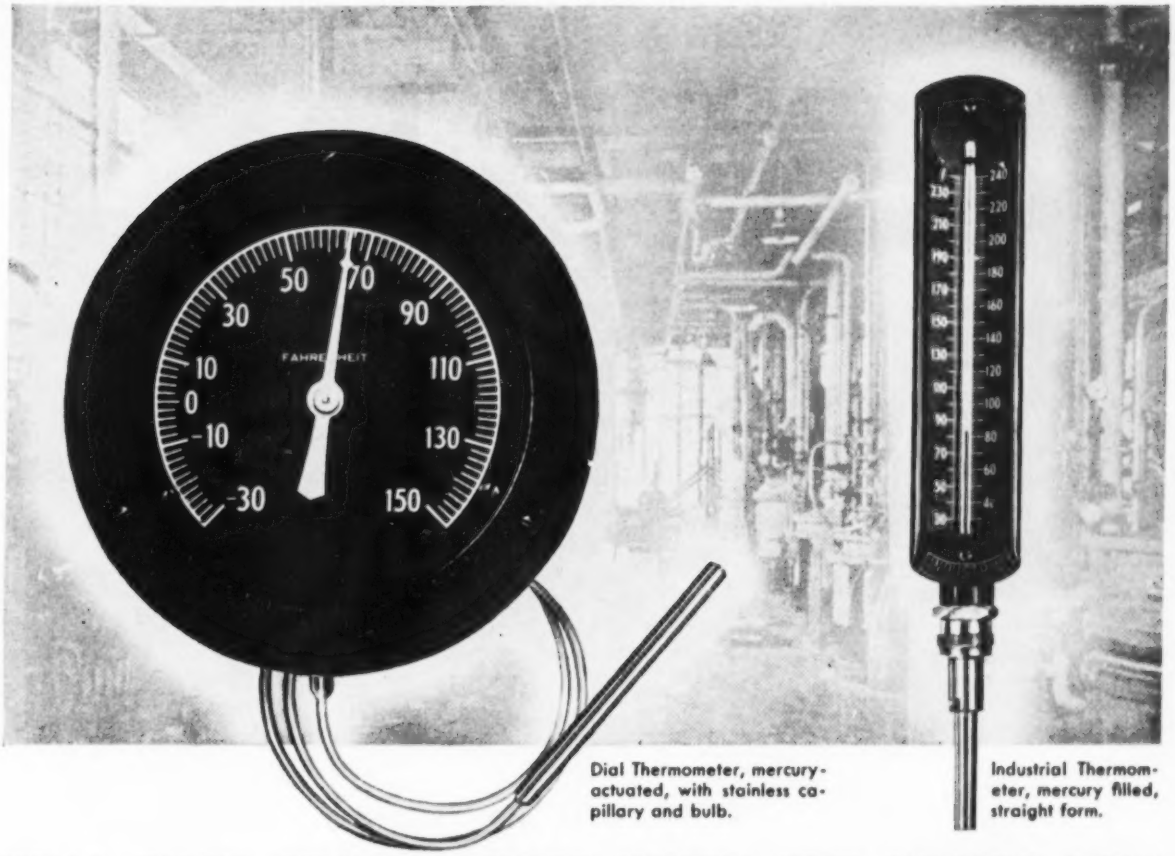
America's Leader's... in Many Businesses... Select

WORTHINGTON

A-2.11

AIR CONDITIONING AND REFRIGERATION

The Most Complete Line... Always the Correct Recommendation



Dial Thermometer, mercury-actuated, with stainless capillary and bulb.

Industrial Thermometer, mercury filled, straight form.

WILL THEY STAY HONEST WHEN THE HEAT'S ON?

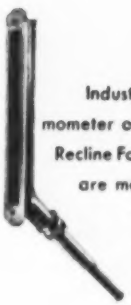
Rigid quality control and thorough testing of every USG Thermometer under actual operating conditions say *they will!*

So does the fact that USG sells no makeshifts. Regardless of your process or application, there's a USG Thermometer that suits it precisely. You may choose Industrial Types in all sizes, and mounting forms with standard or protected stems —or Dial Types in a variety of sizes, case styles, mountings, ranges and connections. *All* USG Thermometers—gas, mercury, or vapor-actuated—are built to the same high quality standards as USG Pressure Gauges!

If you're interested in typical applications of commercial and approved Navy Standards, dimensional information and the use of bushings, flanges, sockets and special tubing, send for Catalogs 100 and 200.

Special thermometers for dough testing, milk testing, fuel gas, candy, solder baths, varnish, canning, vulcanizing and other unusual processes.

Dial Thermometer with bottom-connected rigid stem, one of many USG types available.

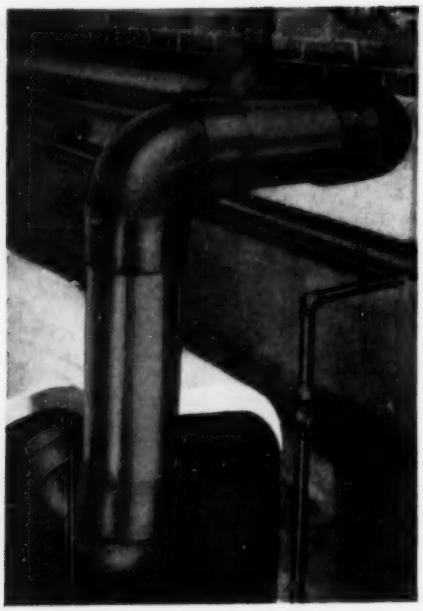


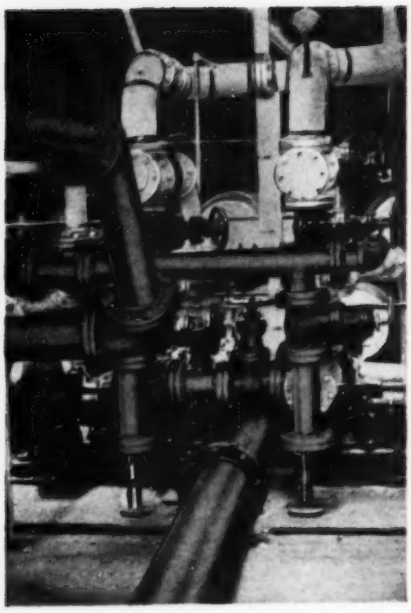
Industrial Thermometer of the 45° Recline Form. There are many other standard forms.

UNITED STATES GAUGE

United States Gauge
Division of American Machine and Metals, Inc.
Sellersville, Pa.
Gentlemen: We are interested in USG ☐ Industrial Thermometers; ☐ Dial Thermometers. ☐ Please send us your catalog. ☐ Have your man call. No obligation, of course.

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____





Quick Quiz

on copper piping

Q **Isn't copper tubing more expensive to use than piping made of other materials?**

A In some cases, yes. In most cases, no. There are many conditions under which ANACONDA Copper Tube proves to be the *least* costly piping obtainable. Prevention of rust, corrosion and contamination, together with the lower labor costs of installing solder-type fittings, often more than offset differences in piping material cost.

Q **Why is copper tube easier to install?**

A There are many reasons. First, ANACONDA Copper Tube is light, easy to handle. Second, it comes in longer lengths, which saves cutting and fitting. Third, it is more flexible, can be bent on the job—again saving cutting and fitting. Fourth, required connections are fast and easy to make. No threading.

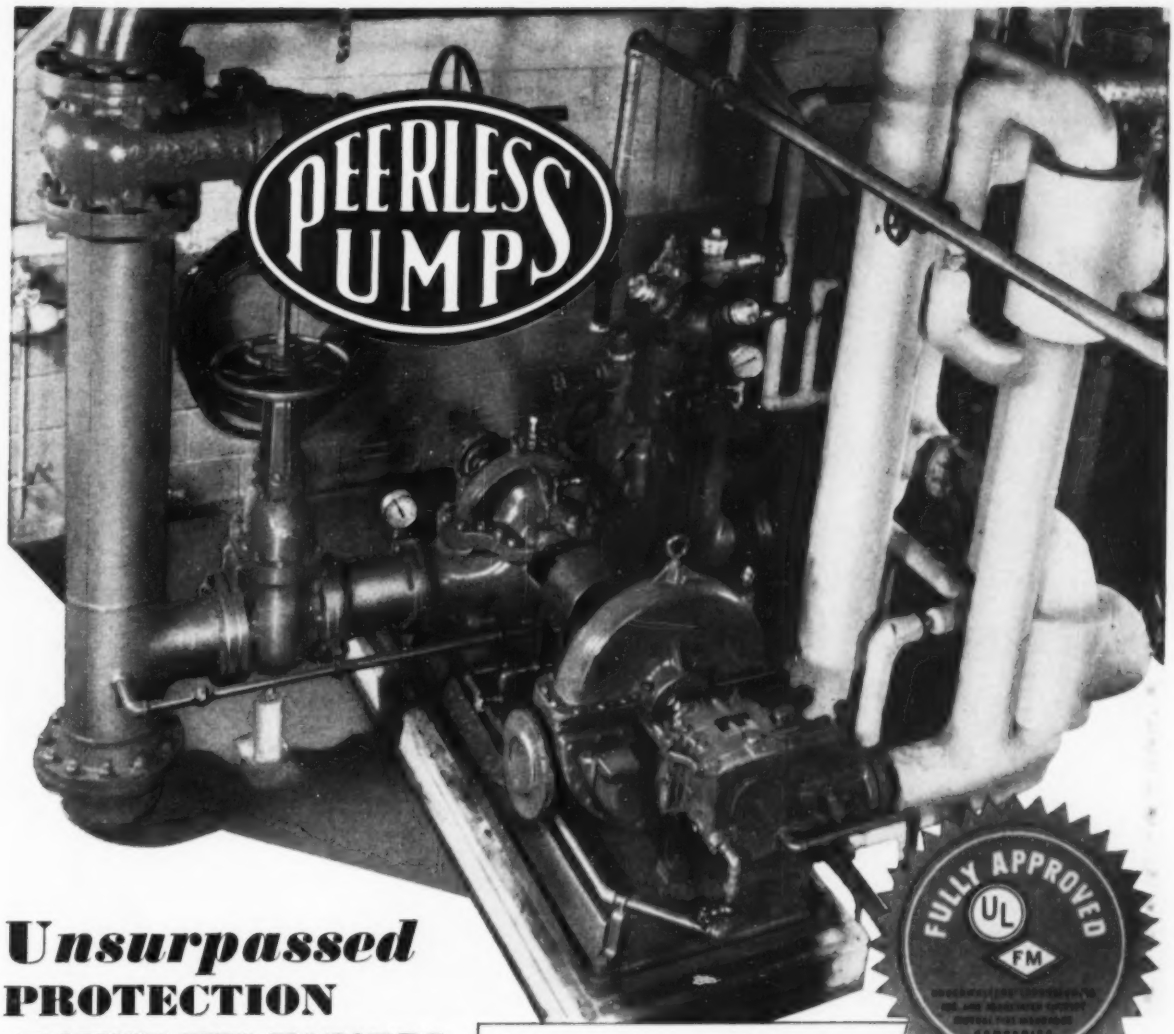
Q **Are changes in piping systems hard to make where copper tubing is used?**

A Definitely no. Once installed, copper tubes connected with solder fittings can be taken down, moved, or have new connections cut in faster and with less expense than with threaded pipe.

Q **Where can I get more facts?**

A A well illustrated booklet, "ANACONDA Copper Tubes for Industrial Applications," is available on request. It contains a wide range of information on copper tubes, their applications, advantages and installation. Numerous reference tables useful to user and installer are also included. For a copy of this booklet, ask for Publication C-24 and send your request to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

for better piping...use ANACONDA® **COPPER TUBES**



Unsurpassed PROTECTION

AGAINST THE HAZARDS OF FIRE *with*

1. *THE CORRECT PUMP*
2. *APPROVED AUXILIARY EQUIPMENT*
3. *SKILLED APPLICATION SERVICE*

ITEM: Last year over ¾ of a billion dollars worth of property went up in flames. To those charged with the responsibility of plant fire protection this all time high loss once more underscores the paramount necessity for a modern fire protection system. The heart of this system should be a Peerless (Dayton-Dowd design) fully approved fire pump. A Peerless engineer will show you, without obligation, how a Peerless fire pump, plus approved auxiliary equipment, plus Peerless' exacting installation service will guard your property and perhaps reduce insurance rates. Many installations can be paid for in a few years with savings effected from more favorable insurance premiums. Peerless fire pumps are available for high pressure or foam smothering systems as applied to refineries and oil field installations or for plant standpipe, sprinkler or hydrant systems.

WRITE FOR 24 PAGE BULLETIN describing the complete Peerless line of fire pumps. Profusely illustrated. Complete with data on pumps and fittings and auxiliary equipment and pump selection charts. Mail coupon at right.

PEERLESS
Fully Approved FIRE PUMPS

PEERLESS PUMPS

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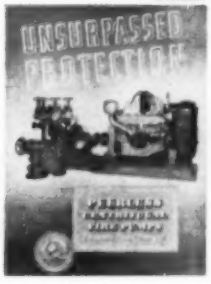

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles, Calif. and Indianapolis, Indiana.
Offices: New York; Atlanta; Chicago; St. Louis; Indianapolis; Phoenix; Fresno; Los Angeles; Tulsa; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.
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Food Machinery and Chemical Corporation
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Please send a copy of Peerless Fire Pump Bulletin B-1500

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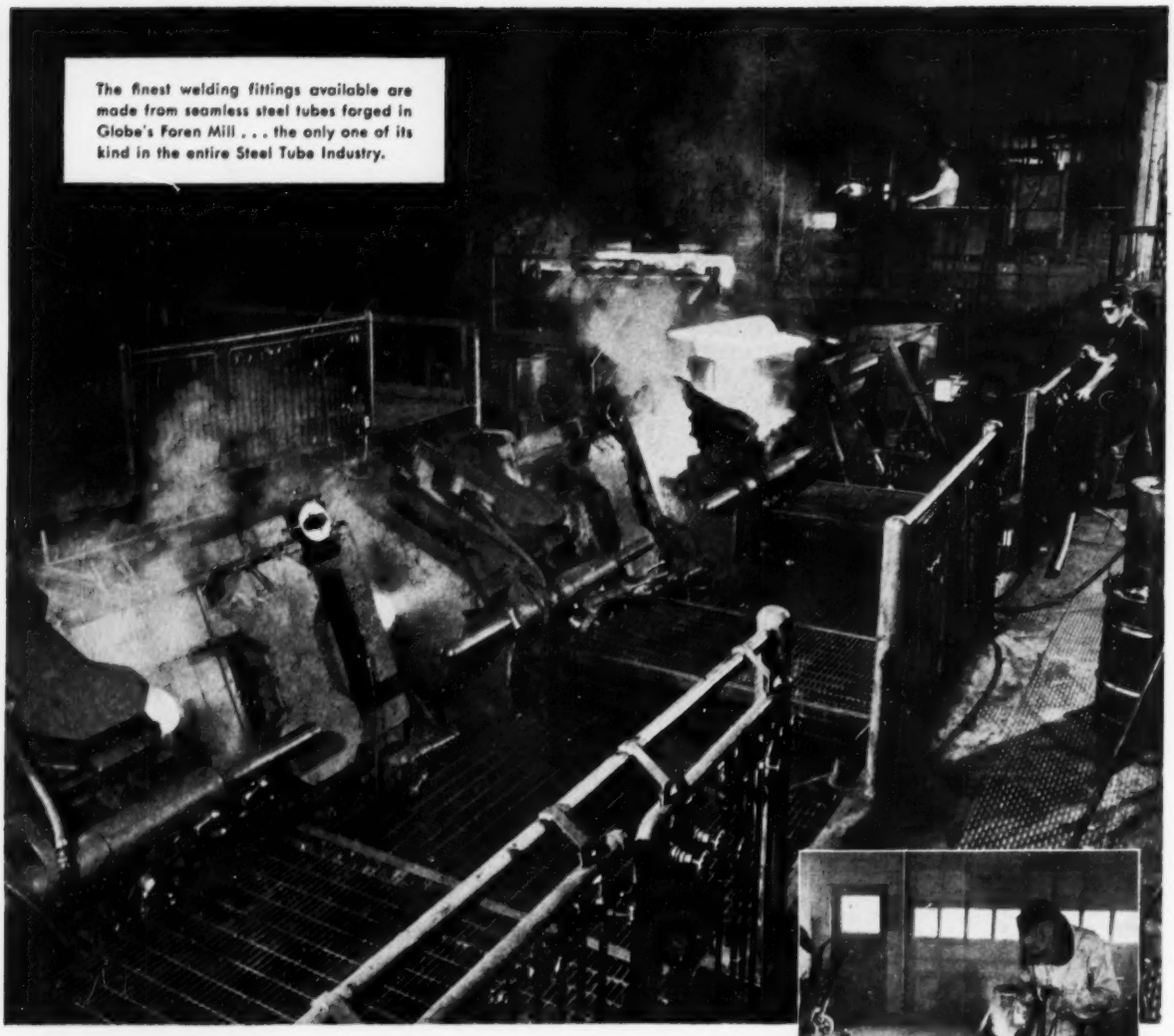
HP & AC


The finest welding fittings available are made from seamless steel tubes forged in Globe's Foren Mill . . . the only one of its kind in the entire Steel Tube Industry.

NOW... get immediate delivery on GLOBE welding fittings...

the only seamless welding fittings precision processed from billet... to tube... to fitting

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For complete information on the finest welding fittings available anywhere, send for the Globe Welding Fittings Catalog.

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Chicago • Cleveland • Detroit • Philadelphia • St. Louis • New York
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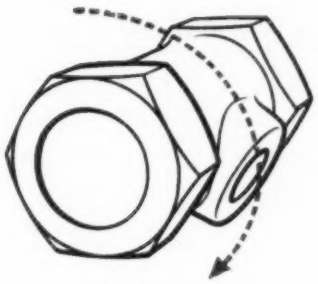
Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.

ONLY ONE MONOFLO FITTING NEEDED FOR MOST INSTALLATIONS

Install a Monoflo Fitting at either the supply or return riser—results are equally effective



Special Down-feed Fittings eliminated

Different Monoflo Fittings for up-feed and down-feed radiators are not required. By *revolving* either a Supply Fitting or Return Fitting so that the riser opening is down, it can be used for down-feed radiators.

B & G Monoflo Fittings enable you to design a forced hot water system with assurance that it will be correctly and efficiently circulated. That's because the Monoflo Fitting is an *engineered* device—not just a "scoop" or "choke."

Under average conditions, *a single Monoflo provides ample diversion capacity!* In abnormally long pipe runs or where unusually large heating loads must be handled, a Monoflo Fitting may be required at both supply and return risers. Down-feed radiation likewise requires two Fittings.

Here's the important point! It would be no trick at all to build enough resistance into Monoflo Fittings so that one fitting would be sufficient under all circumstances. But remember this...*every average job would then be penalized with excessive resistance!* This is particularly true in large installations.

So why waste power... why over-circulate one radiator in order to properly supply another... why take a chance on a noisy system because of excessive water velocity. Use B & G Monoflo Fittings—*correctly designed for most efficient performance!*

BELL & GOSSETT
COMPANY
Dept. CW-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada

JENKINS PRACTICAL PIPING LAYOUTS 66

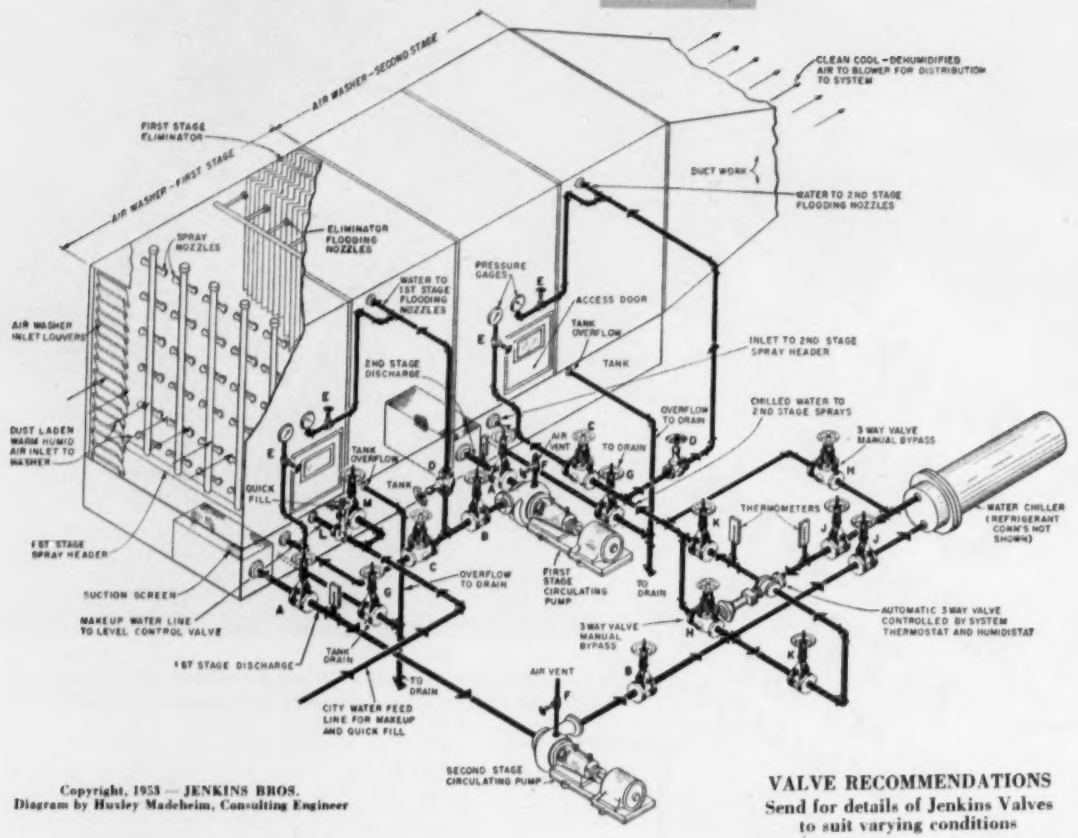


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Diagram by Huxley Madeheim, Consulting Engineer

VALVE RECOMMENDATIONS

Send for details of Jenkins Valves to suit varying conditions

Code	Quan.	Jenkins Valve	Services
A	2	Fig. 651-A, I.B.B.M. Gate	Pump Suction Shutoff
B	2	Fig. 651-A, I.B.B.M. Gate	Pump Discharge Shutoff
C	2	Fig. 142, I.B.B.M. Globe	Spray Header Control
D	2	Fig. 956, Bronze Globe	Flooding Nozzle Control
E	4	Fig. 741-G, Bronze Needle	Pressure Gage Control
F	2	Fig. 741-G, Bronze Needle	Pump Air Vents
G	2	Fig. 651-A, I.B.B.M. Gate	Tank Drains
H	2	Fig. 142, I.B.B.M. Globe	3 Way Valve Manual By-Pass
J	2	Fig. 651-A, I.B.B.M. Gate	Water Chiller Shutoff
K	2	Fig. 651-A, I.B.B.M. Gate	3 Way Valve Shutoff
L	2	Fig. 47, Bronze Gate	Feed to Level Control
M	1	Fig. 651-A, I.B.B.M. Gate	Tank Fill Valve for Start up

How to plan PIPING CONNECTIONS FOR AN AIR-WASHER AIR CONDITIONING SYSTEM

The air washer air conditioning system illustrated is a two-stage installation designed to cool, dehumidify and clean air for non-industrial (comfort) purposes.

Water from a chiller, sprayed through second-stage nozzles, picks up heat from the air stream. This water is collected at the bottom of the tank and, still at a temperature below the dew-point of the entering air-stream, is sprayed through the nozzles of the first stage. Here, too, it cools and dehumidifies the air. The water is then pumped back through the chiller and the cycle is repeated.

Excess moisture is removed between stages by a series of baffles which set up abrupt directional changes in the air flow, causing any droplets of water suspended in the air stream to drop out. Separate water spray keeps the baffles wet to collect dust and dirt from the air stream. Final air condition is automatically controlled by proportionate mixing of chilled and return water by means of a three way valve.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run*. Jenkins Bros., 100 Park Ave., New York 17.

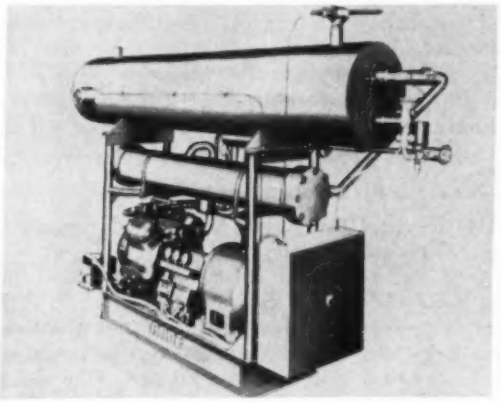
Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 66.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864
JENKINS
Jenkins Bros

EQUIPMENT DEVELOPMENTS...

Packaged Water Chiller

HPAC 1—"Cold generator" said to reduce the cost and upkeep of medium-sized air conditioning units. . . . The generator is designed to provide a single-unit source of large quantities of cold water for air conditioning and refrigeration systems requiring between 10 and 50 tons

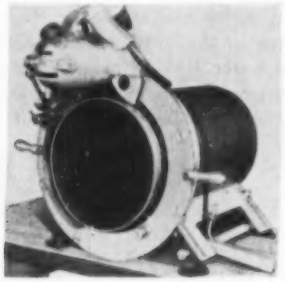


of cooling. According to the manufacturer, installation savings are accomplished by combining compressor, condenser, liquid cooler, controls, motor and accessories in a single factory-assembled unit. [Manufacturer: The Trane Co., La Crosse, Wis.]

Constant Support Piping Hangers

HPAC 2—"Model R" constant support hangers for all positions of travel for high temperature process and steam piping. . . . A feature of the design permits 10 percent increase or 10 percent decrease in their load by field adjustment of a single bolt, and results in hangers which are smaller for the loads carried. Three regular frame sizes providing maximum travels of 4 in., 8 in. and 12 in. are designed for all loads from 48 lb to 9304 lb. Small ratios between spring force and the supported load, ranging from 1.15 to 1 minimum to 4 to 1 maximum, minimize the bearing stress. [Manufacturer: Grinnell Co., Inc., 260 W. Exchange St., Providence 1.]

Hanger



Saw

Power Cutoff Saw for Pipe and Tubing

HPAC 3*—New design of "Super Speed" power cutoff saw. . . . The saw now is available in two models. One model cuts from ½ in. through 6 in. and the other from ½ in. through 12 in. The saw uses abrasive cutting wheels for cutting pipe and tubing of aluminum, copper, stainless steel and other metals in varying wall thicknesses. Operating on 110 volt alternating current, it has a free-moving, rotating ring which encompasses the materials being cut. The saw is attached to the frame so that they rotate together. [Manufacturer: Tri-Clover Machine Co., 2809 60th St., Kenosha, Wis.]

Treatment for Boiler Scale

HPAC 4*—"Borgana", concentrated neutral liquid obtained by caustic extraction from waste wood of Western Red Cedar, which dissolves boiler scale by a physical, detergent-like action. . . . The liquid, developed by the Chemical Div. of the Portland Shingle Co., penetrates between layers of scale and loosens deposited materials. These settle to the lower boiler areas as a non-adherent sludge. It prevents scale from forming in new or cleaned

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section: double asterisk, equipment and manufacturer not listed.

FOR YOUR CONVENIENCE [3-53]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about equipment mentioned under these reference numbers in Equipment Developments.

(Circle each HPAC number in which you are interested)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27

Name _____ Title _____

Company _____

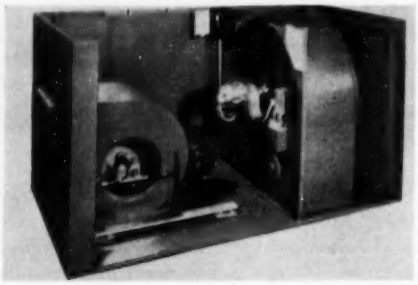
Address _____

City _____ Zone _____ State _____

systems by a filming action in the boiler water. It is nontoxic to personnel either internally or externally and is non-injurious to metals, gaskets or packing materials, says the manufacturer. [Distributed by: Strong, Carlisle & Hammond Co., 1392 W. Third St., Cleveland 13.]

Evaporative Cooler Unit

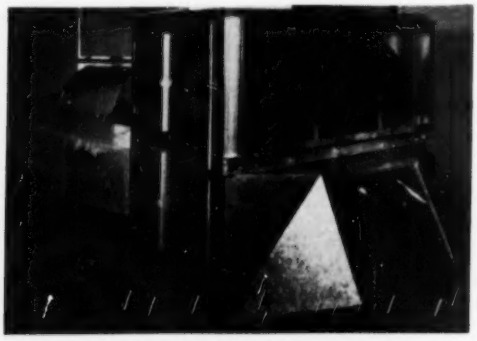
HPAC 5*—New features incorporated in the "Far-Air" package cooler which now includes filters, cooler, blower and motor and automatic flushing controls. . . . New designs in the unit include an improved chemical brick in the water tank to prevent accumulation of salts and minerals on the rotor. and development of a system for automatic, periodic draining and flushing of the water tank



to remove accumulations of minerals and organic material. According to the manufacturer, power consumption has been reduced to 25 percent of that required by mechanical refrigeration types of coolers. It will cool from 100 F and 20 percent relative humidity to 75 F at rated volume. [Manufacturer: Farr Co., P. O. Box 10187 Airport Station, Los Angeles 45.]

Regenerator for Heat Recovery

HPAC 6*—Heat recovery method utilizing the principle of counterflow. . . . Exhaust air is blown through the upper half of the regenerator and ducted out of the building. In passing through metal wool, the heat is extracted from the outgoing air. Fresh air is blown through the bottom half of the wheel at the same time. The wheel revolves slowly and the heat previously transferred to the metal



wool is picked up by the incoming air stream and enters the building at a temperature only slightly changed from the exhausted air. It was displayed in operation at the International Heating, Ventilating & Air Conditioning Exposition held in Chicago the last week in January, where it took heat from air exhausted from the building and used this heat to warm outdoor air introduced into the building. [Manufacturer: Therm-O-wheel, Inc., 95 Liberty St., New York 6.]

Dual Fuel Burner

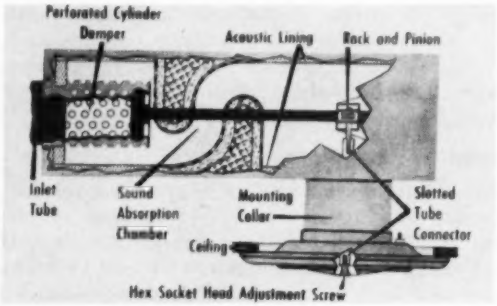
HPAC 7—"Rotonetic" dual fuel burner for firing large heating or industrial boilers. . . . The burner uses either low pressure gas or any grade of fuel oil. The unit is made in six sizes ranging in capacity from 75 to 300 boiler hp. [Manufacturer: Webster Engineering Co., P. O. Box 2168, Tulsa 1, Okla.]

Pipe Markers

HPAC 8*—Markers identify pipes, cable, conduit and flow lines by color and large wording. . . . "Tel-A-Pipes" are available in four types in 200 stock descriptions or printed to specifications. The markers are wrapped around the pipe and adhere without moistening, either indoors or outside, and are designed to stick permanently. They are available in five-color backgrounds, printed in black type. [Manufacturer: Westline Products Div., Western Lithograph Co., 600 E. Second St., Los Angeles.]

High Pressure Air Diffuser

HPAC 9—"Kno-Draft" Type HPR-K high pressure air diffuser which can be dampered from 1 to 4 in. w. g., static pressure, permitting balancing of systems where volume requirements may vary anywhere from 50 to 100 percent from original design. . . . Long runs of diffusers serving large areas can be supplied by conduits of uniform size without reduction for take-off. The diffuser



consists of a perforated, cylindrical damper, a sound absorption chamber and a standard circular diffuser. A calibrated damper valve is controlled from below. It is available in neck sizes of 4 to 10 in. and capacities of 70 to 525 cfm. [Manufacturer: Connor Engineering Corp., Shelter Rock Lane, Danbury, Conn.]

Magnetic Plugs

HPAC 10**—Magnetic pipe, drain and filler plugs. . . . The plugs, specially threaded to eliminate leakers, attract abrasive, ferrous particles from oil or lubricant streams. The plugs are made in the standard styles: square heads, square countersunk, hexagon countersunk, slotted, hexagon head, and specials. [Manufacturer: Magnetic Drain Plug Co., Wellington, Ohio.]

Pipe Fitting

HPAC 11**—Shock absorbent fitting for metal tubing and piping. . . . "Sealastic" fittings are designed to be used on fuel, oil, water, air, refrigerant or other lines under a broad range of temperature and pressure conditions. Leaks or breaks from severe vibration do not occur due to elimination of any metal to metal contact. The fitting is made up of a compression nut, housing a synthetic rubber seal fixed to the tube by a metal ferrule. Tube clearance is

NEVER Ventilate a Ceiling or Wall Space to the Inside...

If you do, the better the insulation, the worse will be the condensation; for the colder the air in the space between insulation and roof, or walls, the less vapor can it support.

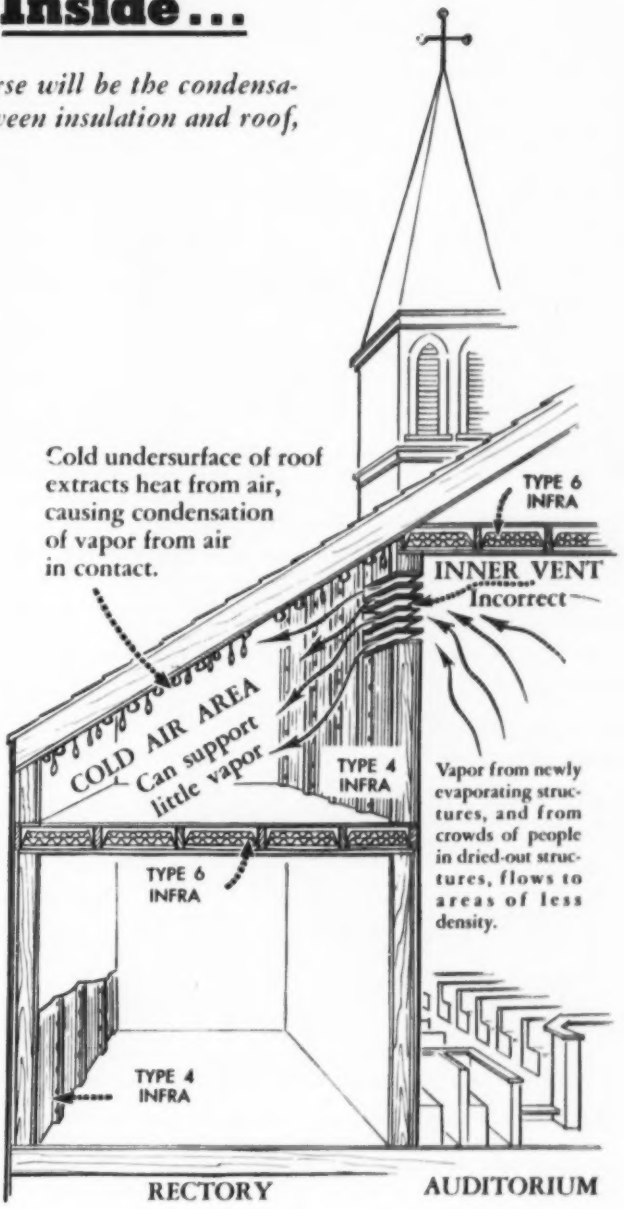
In new construction, thousands of tons of cement and plaster are evaporating. Vapor flows from areas of greater density into this small, cold space, an area of less vapor density and small capacity.

Multiple sheets of accordion aluminum, because impervious to vapor, force out through exterior walls and roofs, ordinary amounts of fortuitous vapor formed from rain leaks, etc. With unusual amounts of vapor, as from crowds, in theatres, schools, stores, etc. provision should also be made to vent this vapor to the *outside*.

In the illustration, an actual case, it was recommended that the inner vents above the insulation be eliminated. More details about this frequent error and other data on vapor flow and condensation sent on request.

Three-sheet accordion aluminum, permanently separated by fiber partitions, is commercially available as Type 6 Infra, and costs less than 9¢ sq. ft., material with labor, installed between wood joists in new construction.

Get valuable FREE copy of new, revised "Simplified Physics of Vapor and Thermal Insulation," authoritative, simply written 56 page manual. Covers heat and vapor flow, condensation, radiant heating, radiation, convection and conduction. Tells how to test insulations yourself and experiment with heat flow. Contains chart of *k*, C, R, and U factors of all insulations, of all thicknesses, weights, densities.


Cold undersurface of roof extracts heat from air, causing condensation of vapor from air in contact.
TYPE 6 INFRA
INNER VENT Incorrect
COLD AIR AREA Can support little vapor
TYPE 4 INFRA
Vapor from newly evaporating structures, and from crowds of people in dried-out structures, flows to areas of less density.
TYPE 6 INFRA
TYPE 4 INFRA
RECTORY
AUDITORIUM

INFRA THERMAL FACTORS. TYPE 6

Up-Heat	**C.089, R 11.23**	= 4⅜" **dry rockwool**
Wall-Heat	**C.073, R 13.69**	= 5⅜" **dry rockwool**
Down-Heat	**C.044, R 22.72**	= 9" **dry rockwool**

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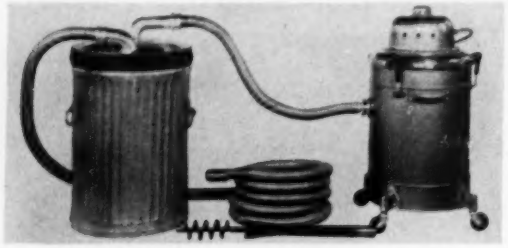
provided in the connection and nut to insure against metal contact between the tube and fitting. No flaring is necessary. [Manufacturer: Chicago Forging & Mfg. Co., 2000 Southport Ave., Chicago 14.]

Vacuum Cleaner for Boilers

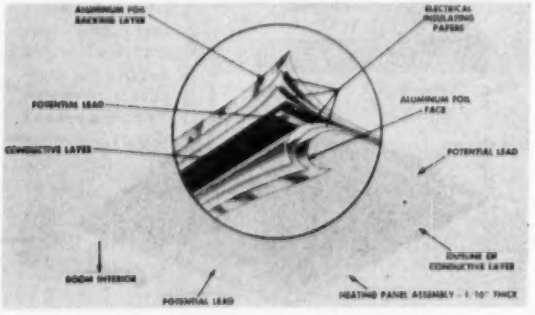
HPAC 12**—Cleaner for boilers and for wet and dry pickup. . . . "Super Vacuum" cleans both large and small tubular boiler and large sectional boilers. In this type of cleaning it is connected by flexible steel coupling to a 25½ gal steel can with an airtight top. It is powered by a ⅞ hp bypass motor which develops 70 in. of water-lift vacuum. With the bypass feature, the motor does



not depend upon the exhaust air to keep it cool. According to the manufacturer, dirt and water cannot be sucked into the power unit, it can run for hours without overheating, does not get dirty and does not require oil or grease. [Manufacturer: Empire Chemical Co., 10 Longworth St., Newark, N. J.]

Electric Heating Panel

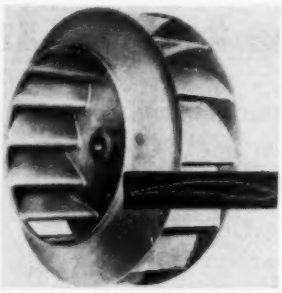
HPAC 13—Electric radiant heating panel which can be cemented to the ceiling like wallpaper. . . . The panel, 1/16 in. thick, is a sheet of conductive rubber that is the heating unit, sandwiched between layers of thin plastic and aluminum foil. Known as "Uskon", the panels weigh 6

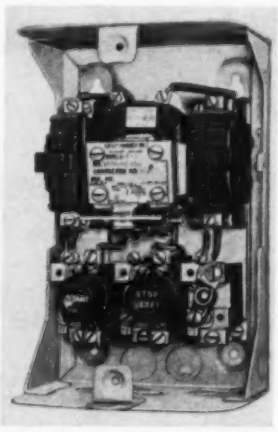


oz per sq ft and are bonded to ceilings of plaster, sheetrock or similar smooth material by means of a special adhesive. The panels are rated at 22 watts per sq ft and are available for either 115 or 230 volts. [Manufacturer: United States Rubber Co., 1230 Avenue of the Americas, New York 20.]

Airfoil Centrifugal Fan

HPAC 11—Centrifugal fan with wheel of the backward curve type with airfoil hollow sectioned blades. . . . This aerodynamic design provides for the greatest volume and smooth flow of air with quiet operation, the company states. The steep pressure characteristic curve of the fan makes it suitable for high pressure air conditioning systems, induced and forced draft applications. Air deliveries are 600 to 750,000 cfm and ⅛ in. to 16 in. static pressures. Efficiencies are said to be over 90%. The wheels are 12¼ in. to 132 in. in diameter. [Manufacturer: Chicago Blower Corp., 9869 Pacific Ave., Franklin Park, Ill.]





Above: Fan

Right: Starter

Magnetic Starters, Contactors and Relays

HPAC 15—Five-unit construction of magnetic starters, contactors and relays for easier installation and longer wear. . . . The five parts consist of two contact blocks, a magnet coil, an armature and a 3-coil or 2-coil overload relay mounted on a steel panel. Each part can be removed from the front without disturbing another part. A wrap-around-cover pulls off, fully exposing the front and both sides of the unit for 180 deg accessibility. All terminals are angled to face front, and are equipped with solderless connectors that take a vise-grip on solid or stranded wire. [Manufacturer: Cutler-Hammer, Inc., 315 N. 12th St., Milwaukee 1.]

Gate Valve

HPAC 16**—Fabricated gate valve designed to give high strength with light weight and reduced maintenance. . . . The construction results in a weight comparable to aluminum but it withstands test pressures of 600 lb per sq in. in both open and closed positions. A straight-through flow reduces turbulence. The valve is designed primarily for petroleum tank trucks and trailers but is suitable for bulk plant or other services requiring steel valves. Available in 3 in. size are two standard models—the hose gate with flanged connection and threaded outlet, and the flanged gate with both connection and outlet flanged. Vitaulic and other special connections or combinations are made on request. [Manufacturer: Allegheny Valve Co., 346 Pennsylvania Avenue West, Warren, Pa.]

Room Air Conditioners

HPAC 17—New line this year comprises five window units and three consoles. . . . Additions to the line are a ¾-ton deluxe model and a 1 ton standard unit. All window models feature the "built-in weather bureau", a push-button control system. Other features are twin filters, V-type evaporators and capillary-type thermostat controls. The rotary grille makes possible the control of air flow at a full 360 deg cycle. Exhaust and intake operations

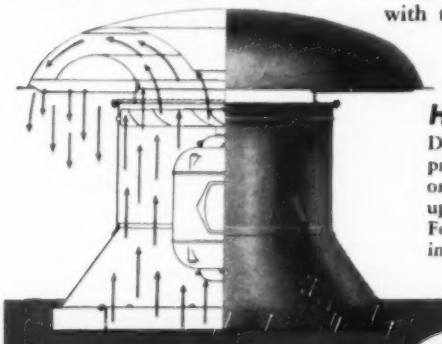
[*Continued on page 245*]

(Photo courtesy of National Biscuit Company)

Smart Cookies LIKE NABISCO CALL FOR Controlled Ventilation

At Portland, Oregon, the modern National Biscuit Company plant is one of the most scientifically equipped food producing establishments in the world. But you can imagine how hot it could get around ovens that turn out several million cookies a day! Plant designers Ford, Bacon and Davis anticipated the need for exhausting hot air caused by baking processes, and came up with the right recipe. 42 DeBothezat Power-Flow Roof Ventilators, each with 21″ fan wheel and 1 HP totally enclosed air-over motor, were installed over the oven area. 19 Power-Flows with 27″ fan wheel and 1 HP motor were installed above the packaging and shipping areas. Altogether these 61 Power-Flow Roof Ventilators exhaust more than 445,000 cubic feet of air per minute. Controlled ventilation assures good working conditions, and is in keeping with the high standards of NABISCO operation and sanitation.

Certified Ratings AMA



HOW ABOUT YOUR PLANT?

DeBothezat Power-Flow Roof Ventilator is a motor-driven fan in a weatherproof housing, for use with or without duct systems, either for air exhaust or intake. Available with fan wheels 12″ through 48″ in diameter, delivering up to 40,900 CFM. Low, streamlined design blends well with all architecture. For catalog containing illustrations, specifications and certified capacity ratings, write our factory, Dept. HP-353, or phone your local DeBothezat agent.

Power-Flow ROOF VENTILATORS

Built by **DeBothezat Fans**

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

What's Your Problem—
CUSTOMER CALL-BACKS?

Deal with

DETROIT!

Quality, Adaptability, and Ease of Adjustment Assure *Peak Performance* from the First Installation

Have you ever stopped to think how much customer call-backs can eat into your reputation as well as your profits? When you look at it this way, it's easy to see how important the quality of the products you sell and install actually is to your business. That's why it pays, in both immediate profits and long range customer goodwill, to install controls you can depend upon—and that means DETROIT Controls. That's because DETROIT Controls, from first design to final inspection, are quality built by men who know your business to provide the kind of heating comfort that turns costly complaints into profitable praise. What's more, all DETROIT Controls are designed for ease and accuracy of adjustment to assure peak performance from the *first* installation. But why not find out for yourself? Stop in and see your DETROIT wholesaler today.

Do You Know the DETROIT *TIMED CYCLING* THERMOSTAT PARALLEL HEATER STORY?

By using a parallel instead of a series heater, the DETROIT system gives you one heater for *all* jobs. There is *no choosing* from a large assortment of heaters—*no adjusting* of variable resistors. No other thermostat will work properly unless the correct heater selection or adjustment is *made*, but the DETROIT Thermostat eliminates all this guesswork because it's *always* just right for the job.

Write for Form No. 1545-A

ESTABLISHED AS DETROIT LUBRICATOR COMPANY IN 1877

DETROIT Controls CORPORATION

5900 TRUMBULL AVE. • DETROIT 8, MICHIGAN

Division of American Radiator & Standard Sanitary Corporation

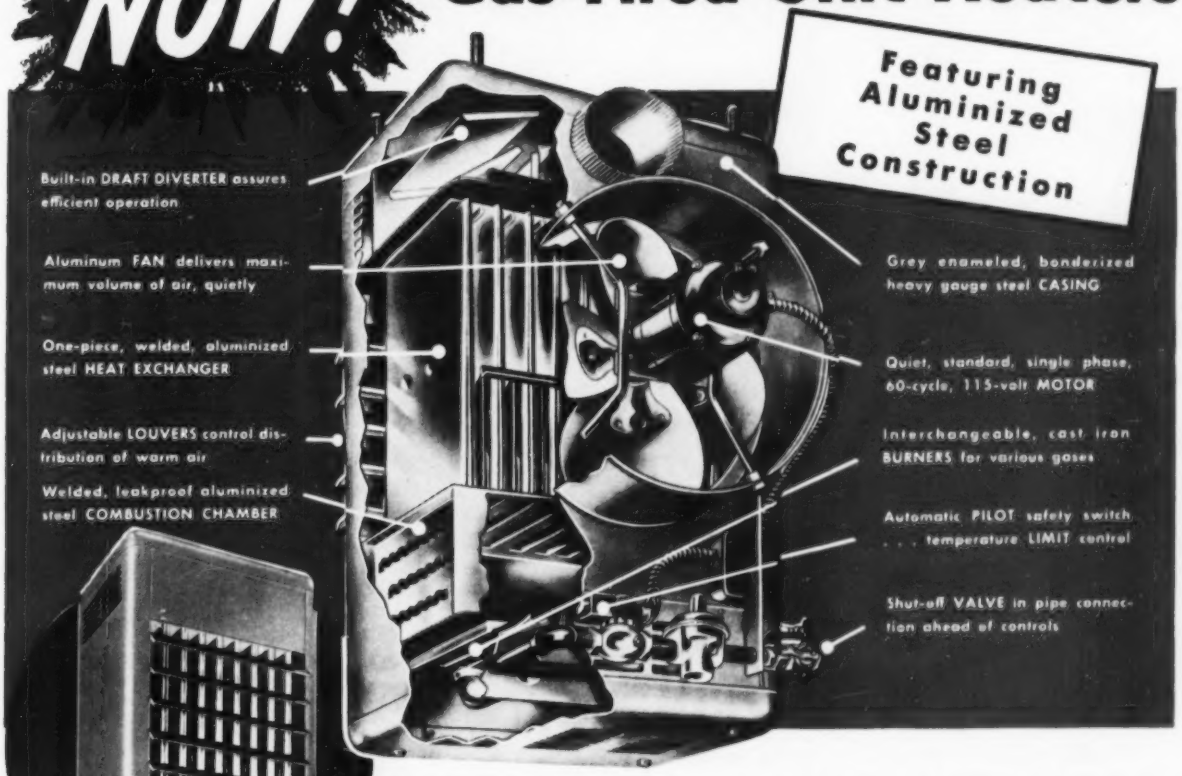
Representatives in Principal Cities • Canadian Representatives in Montreal, Toronto, Winnipeg—Railway & Engineering Specialties, Ltd.

AUTOMATIC CONTROLS for REFRIGERATION • AIR CONDITIONING • DOMESTIC HEATING • AVIATION
TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES

Serving home and industry — AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

NOW! YOUNG OFFERS YOU Gas-Fired Unit Heaters

Featuring Aluminized Steel Construction


Built-in DRAFT DIVERTER assures efficient operation
Aluminum FAN delivers maximum volume of air, quietly
One-piece, welded, aluminized steel HEAT EXCHANGER
Adjustable LOUVERS control distribution of warm air
Welded, leakproof aluminized steel COMBUSTION CHAMBER
Grey enameled, bonderized heavy gauge steel CASING
Quiet, standard, single phase, 60-cycle, 115-volt MOTOR
Interchangeable, cast iron BURNERS for various gases
Automatic PILOT safety switch . . . temperature LIMIT control
Shut-off VALVE in pipe connection ahead of controls

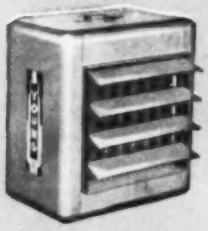
GAS-FIRED

Unit Heaters are available in 7 sizes; 70,000 to 230,000 Btu's; AGA-approved for all kinds of gases.

Other Young Unit Heaters for Steam or Hot Water Systems

"VERTIFLOW"

Unit Heaters for vertical air discharge are available in 7 sizes—in capacities from 52,600 to 552,000 Btu's per hour.

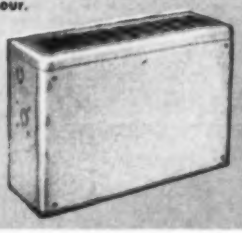


HORIZONTAL

Horizontal type Unit Heaters are available in 14 sizes . . . in capacities from 19,000 to 325,000 Btu's per hour.

CABINET

Cabinet Unit Heaters, available in three basic styles with capacities from 32,000 to 115,000 Btu's per hour, are used in auditoriums, lobbies, recreation halls, etc.



Pioneers in the Heat Transfer industry for more than 25 years, Young Radiator Company now offers you an efficient, dependable and economical Gas-Fired Unit Heater in seven sizes, ranging in capacities from 70,000 to 230,000 Btu/hr. input.

Attractive and modern in appearance, the units feature all welded, aluminized steel combustion chambers and heat exchangers which withstand the corrosive effects of gases and high temperatures, causing discoloration or destructive scaling. This feature alone adds many years to the service life of the Young Gas-Fired Unit Heater. For extra protection against corrosion, the heavy-gauge steel casing is bonderized before enamel is baked on.

Other Young Unit Heaters, available for steam or hot water systems, include the "Vertiflow," Horizontal and Cabinet models. For further details or catalog, see your Young Representative or write direct.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality

Heating, Cooling, Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY

DEPT. 513-C, RACINE, WISCONSIN

You've got a Winning Combination

A STANDARD ISA FACE-TO-FACE DIMENSIONS
K "FLOW LINE" CONTOURED BODY
Q STELLITED SEATING SURFACES
J RENEWABLE SELF-ALIGNING GUIDES
10 SEAT RINGS EASILY REPLACED WITH VALVE IN PIPE LINE

with the New

TRADE **LESLIE** MARK

DOUBLE SEATED DIAPHRAGM CONTROL VALVES

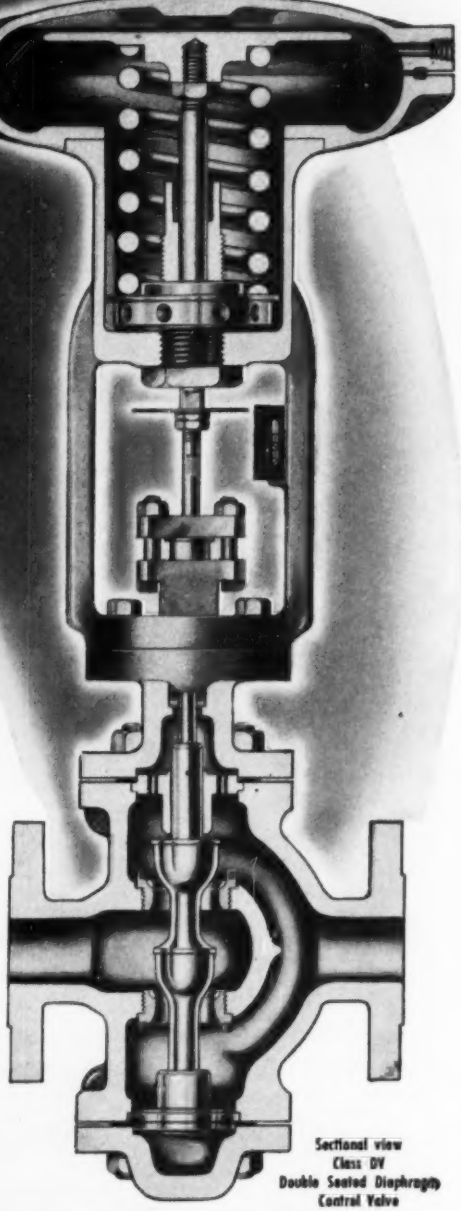
Calling a spade a spade you've got a "royal flush" of features in these new Valves designed for use with control instruments.

Their "Flow-Line" Contoured Bodies have ISA standard face-to-face dimensions and high capacity, low turbulence and minimum body pressure drop characteristics.

A new type, top and bottom guided construction is self-aligning and non-binding regardless of uneveness of bolt tightening.

Standard, integral stellited seating surfaces are recommended for steam service to reduce seat ring thread corrosion. Renewable, interchangeable seat rings also furnished where desired and may be easily replaced without removing valve body from the line. Elaborate grinding at high temperatures is completely eliminated.

With these Valves, you get as *standard equipment*, features heretofore only obtainable in expensive, specially designed valves.



Sectional view
Class DV
Double Seated Diaphragm
Control Valve

***WRITE FOR* Bulletin 513**

ESTABLISHED 1900
LESLIE CO.

8707

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory trained engineers are located:

Albany, N. Y.	Chicago, Ill.	Galveston, Tex.	Memphis, Tenn.	Orlando, Fla.	Salt Lake City, Utah
Albuquerque, N. M.	Cincinnati, Ohio	Greenville, S. C.	Miami Springs, Fla.	Philadelphia, Pa.	San Francisco, Calif.
Atlanta, Ga.	Cleveland, Ohio	Houston, Texas	Milwaukee, Wis.	Pittsburgh, Pa.	Seattle, Wash.
Baltimore, Md.	Dallas, Texas	Indianapolis, Ind.	Minneapolis, Minn.	Ponca City, Okla.	St. Louis, Mo.
Beaumont, Tex.	Denver, Colo.	Kansas City, Mo.	Mobile, Ala.	Providence, R. I.	Syracuse, N. Y.
Birmingham, Ala.	Des Moines, Ia.	Kingsport, Tenn.	Monroe, La.	Richmond, Va.	Tucson, Ariz.
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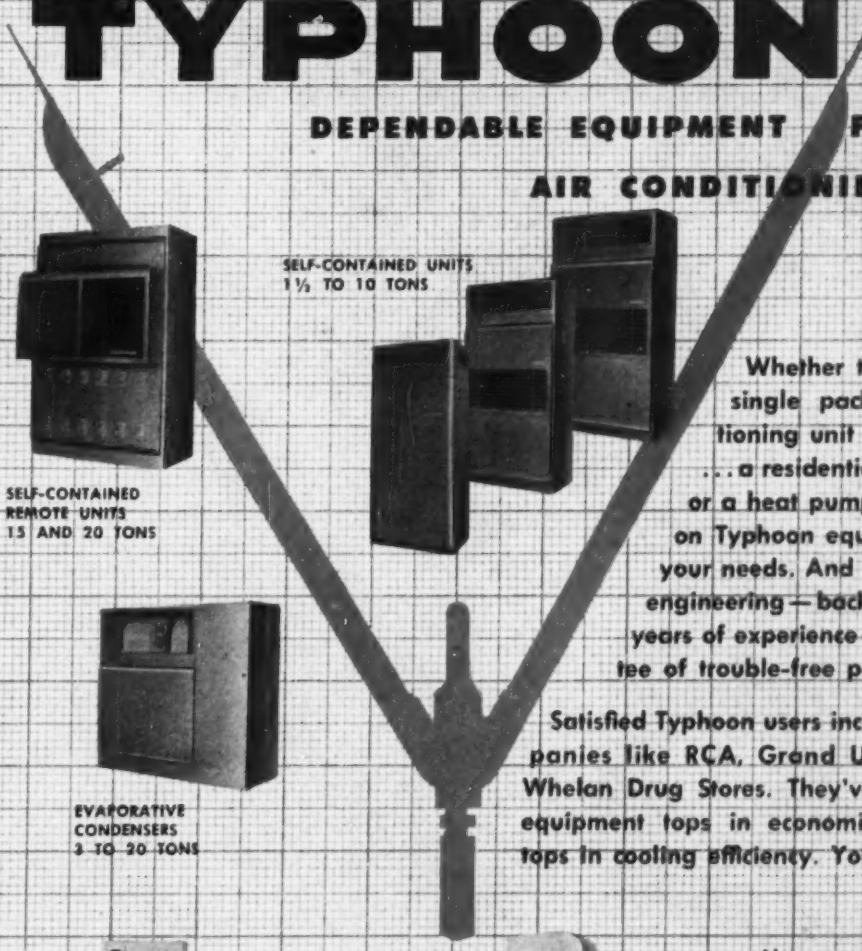
237 Grant Avenue, Lyndhurst, New Jersey

FLOATLESS LEVEL CONTROLS • PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
SELF CLEANING STRAINERS • PUMP GOVERNORS • TEMPERATURE REGULATORS
• AIR HORNS • STEAM WHISTLES

Quality-Engineered by

TYPHOON

DEPENDABLE EQUIPMENT FOR YOUR AIR CONDITIONING NEEDS



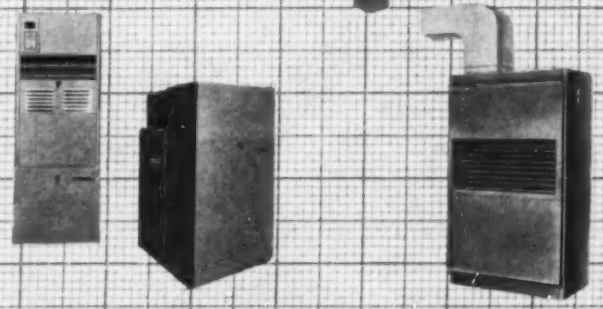
SELF-CONTAINED UNITS
1½ TO 10 TONS

SELF-CONTAINED
REMOTE UNITS
15 AND 20 TONS

EVAPORATIVE
CONDENSERS
3 TO 20 TONS

Whether the job calls for a single packaged air conditioning unit or a central plant . . . a residential year-round unit or a heat pump — you can count on Typhoon equipment to supply your needs. And Typhoon's quality engineering — backed by over 40 years of experience — is your guarantee of trouble-free performance.

Satisfied Typhoon users include famous companies like RCA, Grand Union Stores and Whelan Drug Stores. They've found Typhoon equipment tops in economical operation . . . tops in cooling efficiency. You will, too.



RESIDENTIAL SUMMER-WINTER UNITS
2, 3, 5 TONS

PROP-R-TEMP
HEAT PUMPS
2 TO 20 TONS

Also . . .
Heating and Cooling Coils
Air Handling Units
Cooling Sections to Supplement Furnaces
Water Chillers
Multi-Package Systems
Steam or Water Boilers
Window Units ⅓, ½, ¾ and 1 HP

Write for Detailed Information

TYPHOON AIR CONDITIONING CO., INC.

794 Union Street, Brooklyn 15, N. Y.

Specialists in Air Conditioning Since 1909

NOW! A BRAND-NEW BULLETIN SHOWING the COST-CUTTING FEATURES of the FAMOUS EconoTHERM Boiler

Read about a *modern* boiler — *streamlined* to present-day engineering standards — and built by an old, experienced firm with new ideas!

See all the advantages of the EconoTherm's *exclusive* off-center firing fully described!

Check over each up-to-the-minute fact on EconoTherm's top-quality features.

INDUCED MECHANICAL DRAFT • ROTARY COMBUSTION • FULLY AUTOMATIC OPERATION • MODERN WELDED BOILER SHELL • STAINLESS STEEL AIR RING • GAS, HEAVY OIL, LIGHT OIL FIRING • COMPLETELY "PACKAGED" DESIGN

Then see how these features combine to give you *everything you're looking for in a long-lived, efficient steam generator!*

GET YOUR COPY NOW!
Write for EconoTherm
Bulletin EC-52 G

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Dutton BOILERS

KALAMAZOO, MICHIGAN • DIVISION HAPMAN-DUTTON COMPANY
BOILER BUILDERS SINCE 1880
FOUR TYPES — SIZES FROM 5 to 250 h.p.

Chicago PUMPS

ARE BETTER PUMPS FOR EVERY BUILDING SERVICE

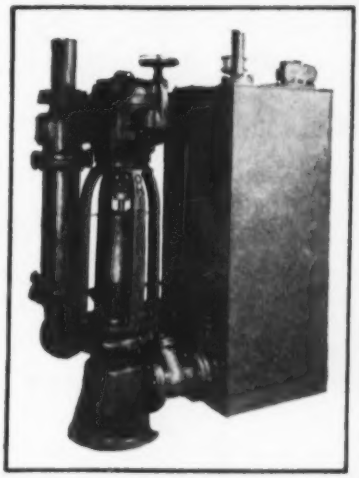
BILGE PUMPS AND SEWAGE EJECTORS

For reliable heavy duty service engineers consistently specify CHICAGO Bilge Pumps and Sewage Ejectors. Bilge pumps from 1¼" to 8" with capacities from 5 to 5000 G.P.M. Sewage Ejectors from 3" to 8" with capacities from 50 to 5000 G.P.M. In addition to the pumps illustrated, dry pit open shaft pumps are also available. All closed shaft pumps have an intermediate guide bearing for every 3 to 4 ft. of shaft, depending on the pump length. The upper thrust bearing is located well above the floor level. Tongue and groove construction throughout insures accurate alignment.

CHICAGO INDUSTRIAL PUMPS

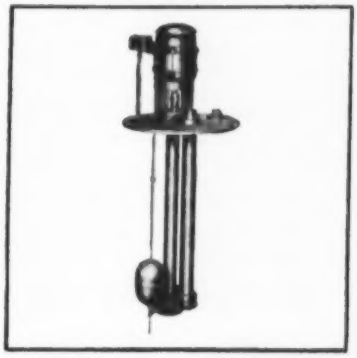
FLUSH-KLEEN SEWAGE EJECTOR TYPE S

The only positively clog-proof sewage ejector. Flush-Kleens are furnished as a complete package, as illustrated, or in duplex for submerged or dry well installations. Described in Bulletins 122-C, 122-S.



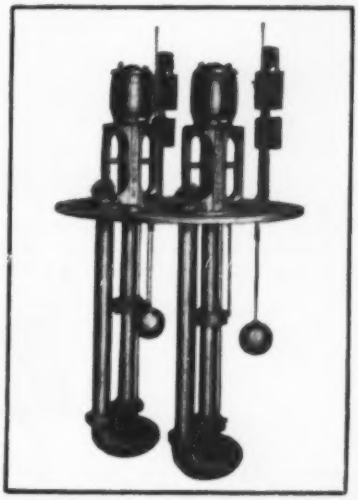
TYPE LG12 AUTOMATIC ELECTRIC BILGE PUMP

Specifically designed to drain basements, pits and sumps. Centrifugal volute pump with open bronze impeller. A cast iron strainer of large area surrounds the suction opening. Described in Bulletin 118.



DUPLEX VERTICAL CLOSED SHAFT NON-CLOG PUMPS

These pumps are suitable for either bilge or sewage service. Complete control equipment is mounted on the basin cover. Each pump is mounted on separate floor plate to allow easy removal of either pump for servicing. Described in Bulletin 124.



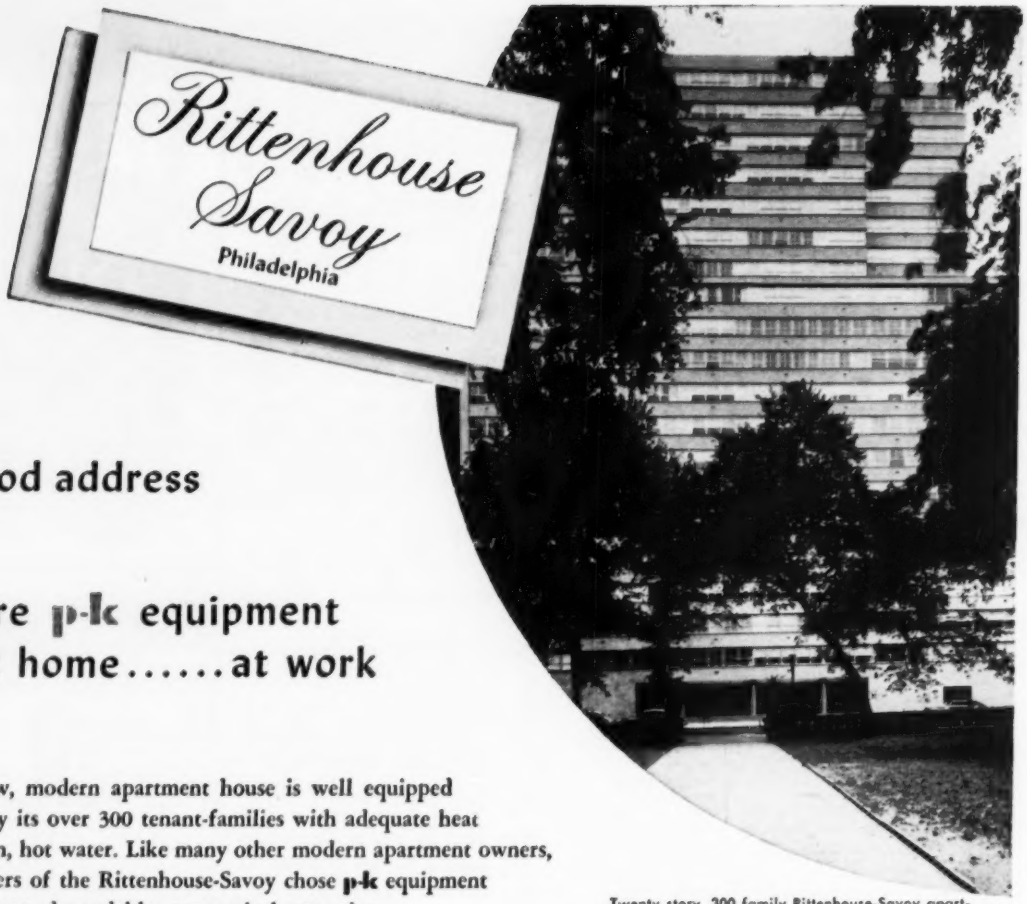
CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

632 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems.

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

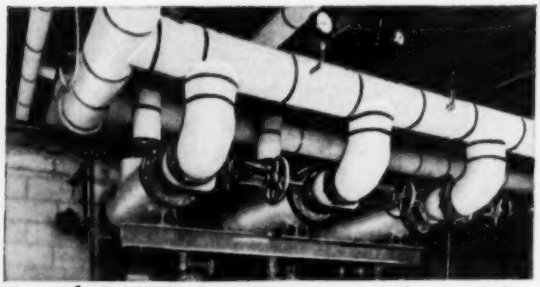


a good address

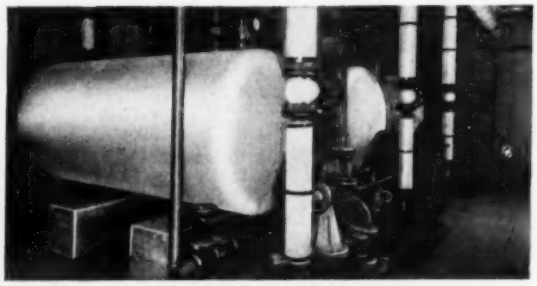
where p-k equipment is at home.....at work

This new, modern apartment house is well equipped to supply its over 300 tenant-families with adequate heat and clean, hot water. Like many other modern apartment owners, the owners of the Rittenhouse-Savoy chose p-k equipment for efficient, dependable, economical operation. Full information and engineering help is yours for the asking. Write today.

Twenty story, 300 family Rittenhouse-Savoy apartment building on fashionable Rittenhouse Square, Philadelphia. Owners: M. H. McCloskey and Kevy K. Kaiserman; Builders: McCloskey & Co., Architects: J. Raymond Knopf, Samuel I. Oshiver, J. Ethan Fieldstein; Structural Engineer: Robert J. McLaughlin; Consulting Mechanical Engineer: Robert J. Tarleton; Mechanical Contractors: Ambrose-Augusterfer Corp.



Three p-k Hot Water Converters are in use at the new, modern Rittenhouse-Savoy, on fashionable Rittenhouse Square, Philadelphia. Each heats 480 gpm of water from 160°F to 180°F with steam at 25 psig pressure. Steam supply is purchased from public supplier.



Three 48" x 120" Type B p-k Hot Water Storage Heaters, each containing two heating elements. Each has a live steam section to heat 2000 gph from 40°F to 180°F with steam at 5 psig. A 50 sq. ft. condensate cooler is built into each section.

the **Patterson-Kelley Co.,** *Inc.*

730 Burson St., East Stroudsburg, Penna.

leaders in heat transfer equipment since 1880

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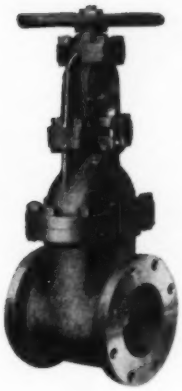
101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

The complete KENNEDY line is

JOB-FITTED to help you select the right valve for every job



IRON-BODY VALVES. Gate, globe, angle and check. Working pressures from 25 lbs. through 800 lbs. Sizes from 2" through 60". Bronze-mounted or all iron, available in a wide variety of disc and stem designs and special construction features.

BRONZE VALVES. Gate, globe, angle, check and radiator valves. Working pressures from 125 lbs. through 300 lbs. Complete range of sizes from ¼" through 3", some through 6", in all popular disc designs. Both Inside Screw and O. S. & Y. types.

LOW-PRESSURE BRONZE VALVES. Gate, globe, angle, check and radiator valves. Exceptionally sturdy construction. Gate valves up to 3". Globe, angle and radiator valves to 2". All available with screwed ends, some available with solder joint ends.

CAST-IRON PIPE FITTINGS. Full line of cast-iron screwed fittings, standard and extra heavy; flanged fittings and flanges, standard and extra heavy; drainage fittings; Underwriters' Approved sprinkler fittings. Individually tested and inspected.

MALLEABLE-IRON AND BRONZE PIPE FITTINGS. Complete line of malleables in a tough, close-grained iron with a tensile strength of 43,000 lbs. p.s.i. Full line of bronze fittings, individually air-tested and inspected for complete on-the-job dependability.

KENNEDY-PENNIE BACKWATER VALVE. Provides a gravity-operated, positive-acting seal against backwater, sewer gas and vermin. Can be easily counter-balanced for vertical or inclined operation. Easily installed. Available with bell inlet, spigot outlet.

KENNEDY JOB-FITTED VALVES

THE KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS

RUGGEDLY BUILT

for LOW-COST SERVICE

DESIGNED TO MEET MODERN INSTALLATION, SERVICE AND INVENTORY DEMANDS, TACO CIRCULATORS PROVE TOP DOLLAR VALUE

EXCLUSIVE FEATURES SPELL QUALITY CONSTRUCTION

LARGE POWERFUL MOTOR. Has power to spare. Overload protected and resiliently mounted for quiet operation.

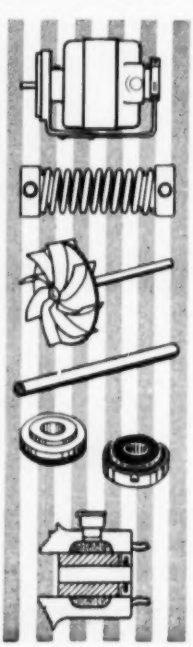
STRONG FLEXIBLE DRIVE SPRING isolates impeller from motor for quiet vibrationless operation.

CAST BALANCED IMPELLER (Not stamped). Casting the impeller in one piece makes certain of long uninterrupted service.

HARDENED GROUND STAINLESS STEEL SHAFT. Made to a plus tolerance of zero and minus tolerance of .0004. Then superfinished for long life smooth operation.

PATENTED ROTARY SEALS. Highest quality rotary seals make for trouble free operation.

POROUS BRONZE BEARING-LARGE OIL RESERVOIR. Long porous bronze bearing lubricates impeller shaft while keeping it in perfect alignment.



Contractors and big users alike are enthusiastic about the new Taco Circulators — and with good reason. This big-value line is specifically designed to meet the needs of the heating market of *today:*

Extra capacity for small pipe radiant heating jobs — radiator, convector, baseboard or panel. Just one size circulator to stock and use — with ¾", 1", 1¼" and 1½" interchangeable flanges to handle any job.

Easy to service — seals replaced with only an open end wrench, screwdriver and Allen set screw wrench. Quiet — no velocity noises regardless of flange size. Designed for six position installation, the new Taco circulator comes in special window carton with flanges individually packed for quick changing.

Better Heating-Better with Taco

Taco

TACO HEATERS, INCORPORATED, 137 SOUTH STREET, PROVIDENCE 3, R. I.

Only DRAVO *Counterflo* Space Heaters offer you these 5 exclusive features:

Ideal for heating large open spaces in industrial, commercial and educational buildings, standard Dravo *Counterflo* Space Heaters have five exclusive advantages over other warm-air space heaters.

1 The Dravo *Counterflo* combustion method takes place in a stainless steel combustion chamber. The exhaust gases from combustion are "whirl-cooled" through two sets of economizer tubes. This four-pass heat transfer results in a minimum heating efficiency of 80%.

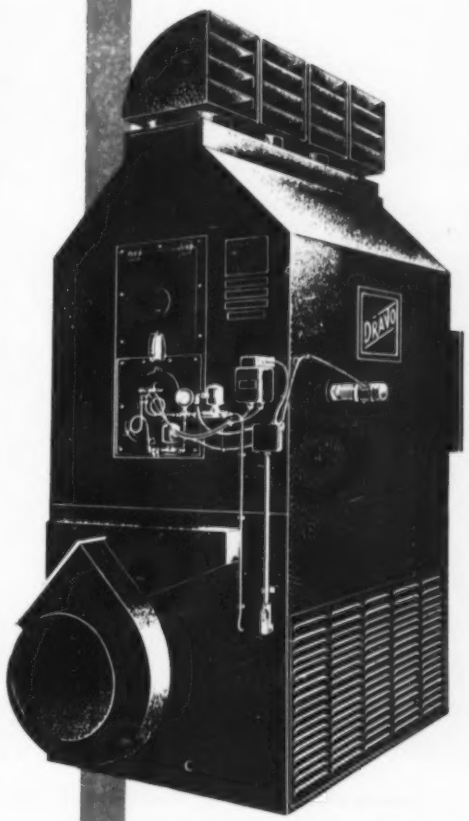
2 One rotor shaft operates all heater fans, thus co-ordinating exhaust, air-intake and heat-discharge systems.

3 Air for combustion is provided by main supply fan; volume and velocity are controlled by an adjustable damper.

4 Approved by American Gas Association and listed by Underwriters' Laboratories, Inc.; Dravo Safety Control Circuit is accepted by Factory Mutual Engineering Division.

5 Burners are designed by Dravo Engineers for top efficiency. Heaters burn gas or oil; burners are interchangeable to take advantage of fuel savings by using the most economical source of supply or in times of shortage the most available fuel.

Dravo *Counterflo* Space Heaters in addition to comfort heating are easily adapted to heat curing and process drying, tempering of replacement air and summertime ventilation. Dravo Heaters can also be tied in with air conditioning systems by making use of the same ductwork.



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Dravo Corporation, Heating Department
Dravo Building, Fifth and Liberty Avenues
Pittsburgh 22, Pennsylvania

Send me information about heating for the subjects I've checked, and Dravo Heater Catalog MN 523-9102.

- ☐ Space heating warehouse, garages, hangars.
- ☐ Stores, schools and auditoriums.
- ☐ Process drying and heat curing.
- ☐ Tempering make-up air.
- ☐ Temporary heating.
- ☐ For use in conjunction with air conditioning.
- ☐ Please have a representative call at no obligation to me.

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MICROLITE *Glass Fiber Insulating Wool* is one of the most effective of all insulating materials and easily met rigid Government specifications. For example, ½ pound density Microlite used in these buildings has a "k" value of .26 at 75° F. mean temperature.

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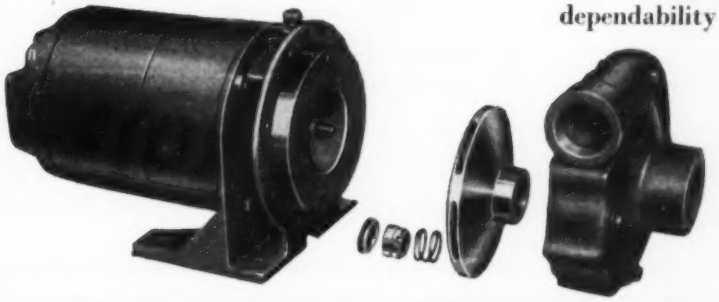

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Please send me Bulletin No. 624-A3 describing the new Fig. 3642 close-cupld centrifugal pump.

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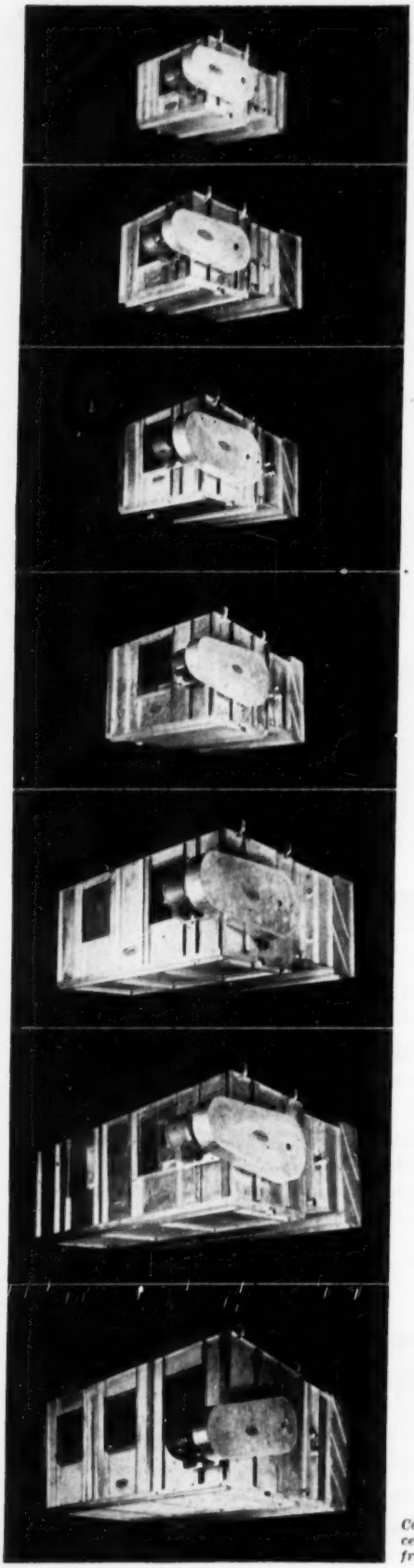

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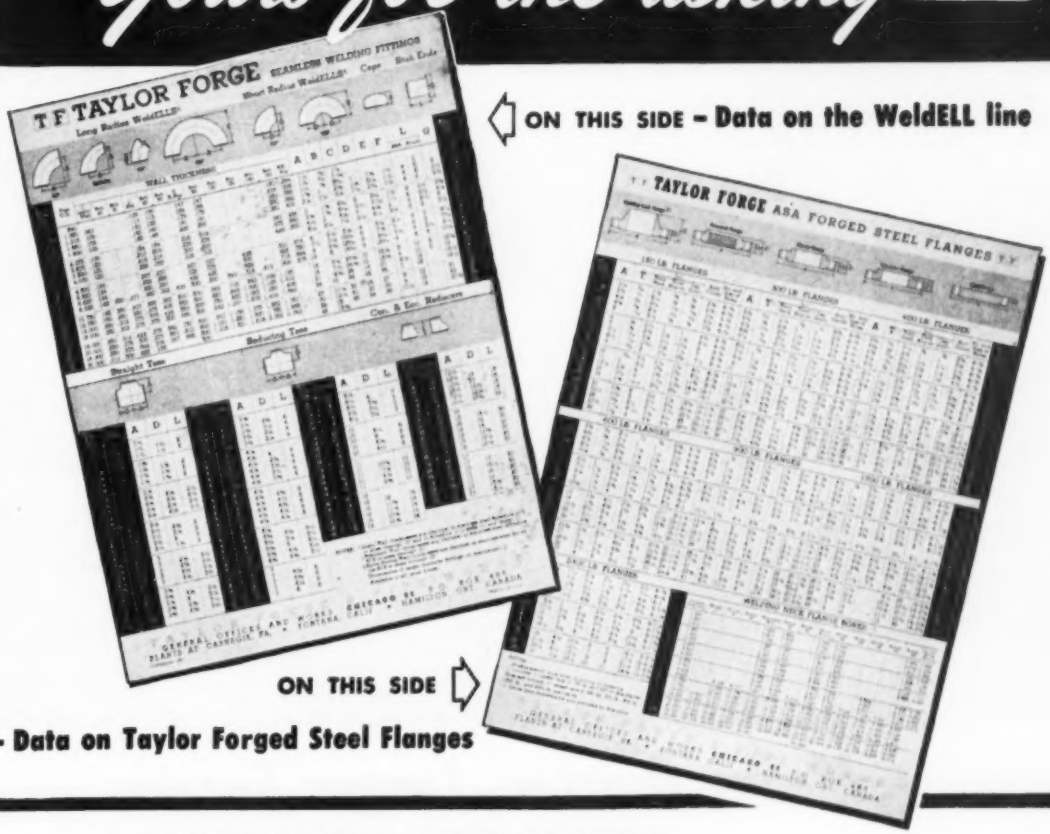

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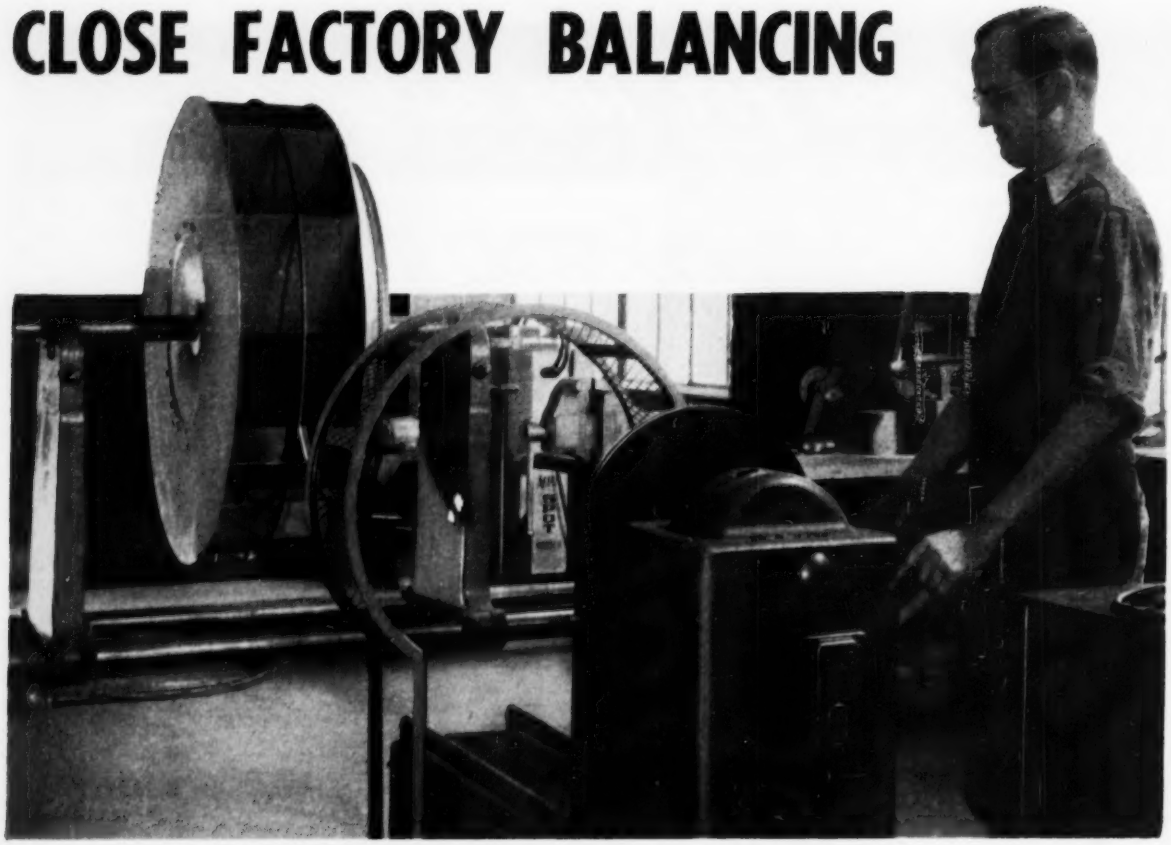

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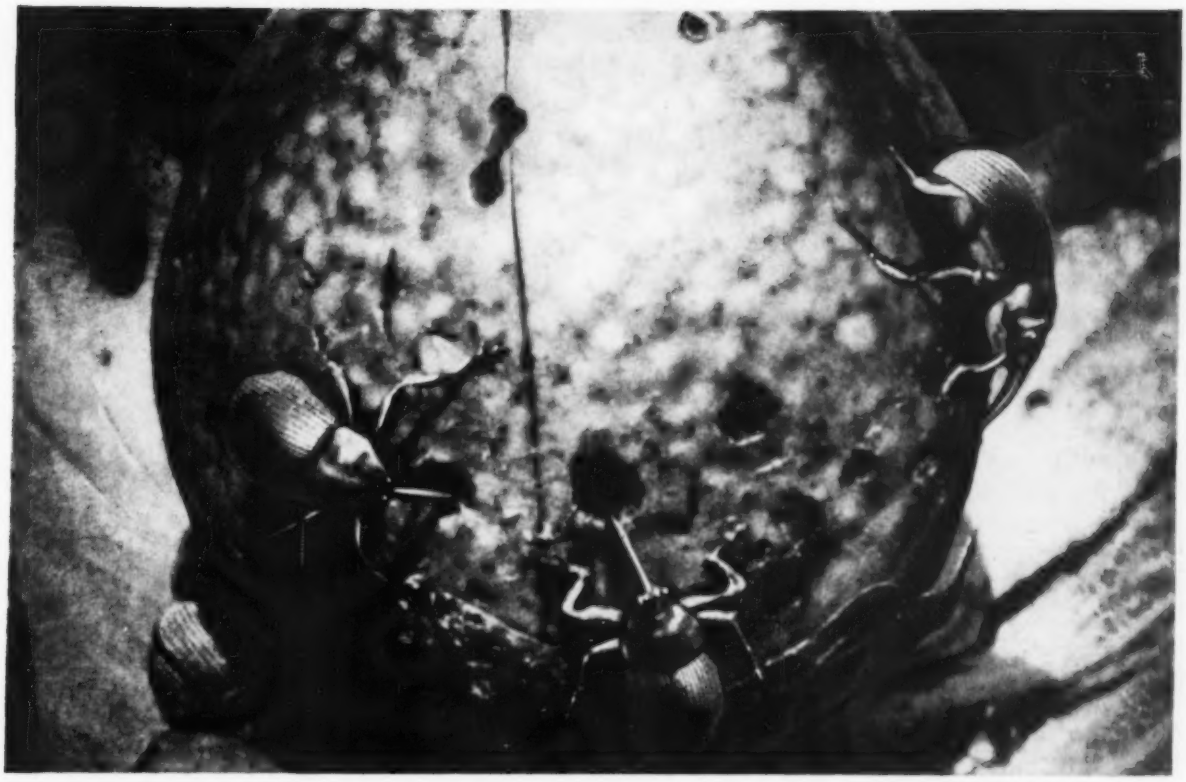

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$500,000,000—that's what those little beetles on the cotton plant above cost America in 1950. The boll weevil adds a whopping $10.00 a year to the price every one of us pays for cotton goods. Producing four to five generations a season, the female boll weevil first destroys the flower buds of the cotton plant by laying her eggs in them; later generations deposit their eggs in the cotton bolls, where the greedy grubs raise havoc with the silky cotton fibers. The boll weevil is probably the most destructive of all insect pests, and has forced large agricultural areas to abandon the growing of cotton altogether.

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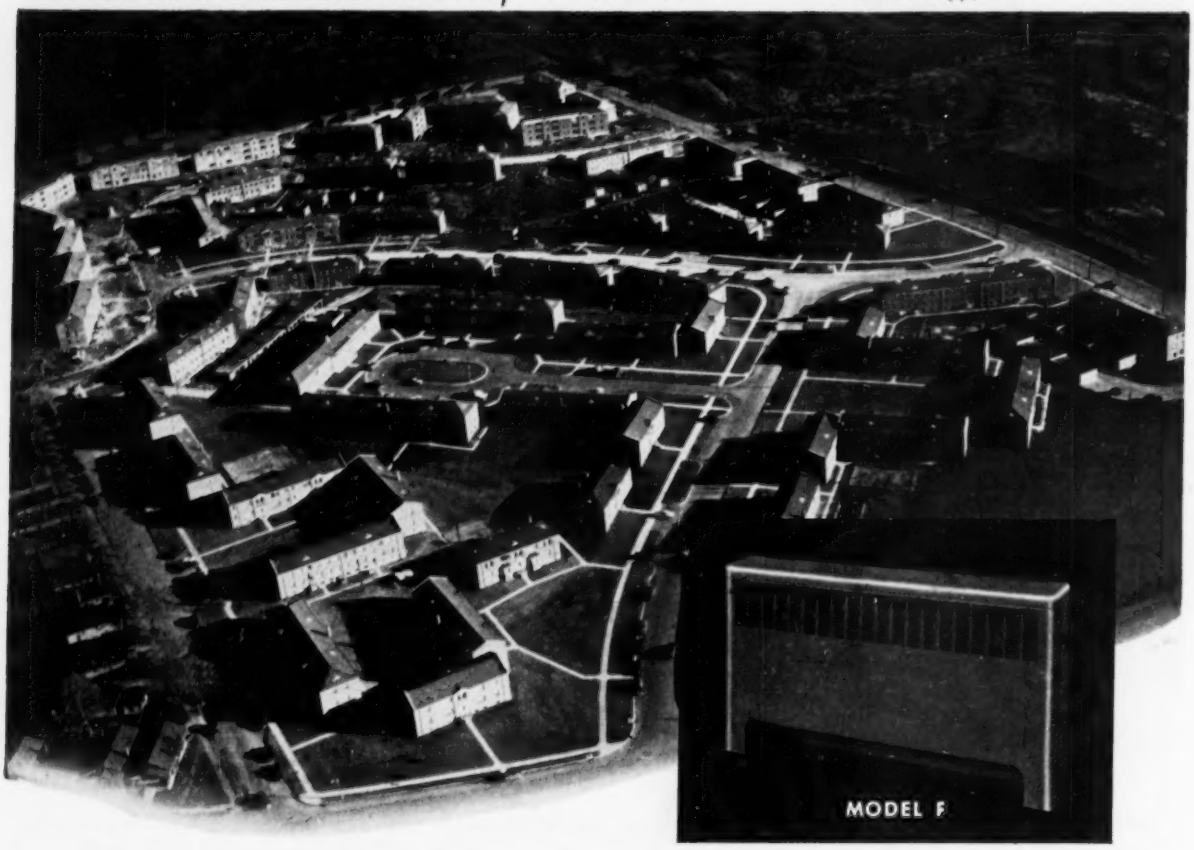

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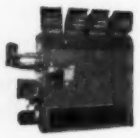
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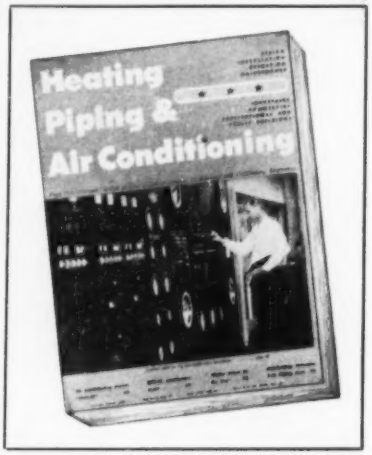

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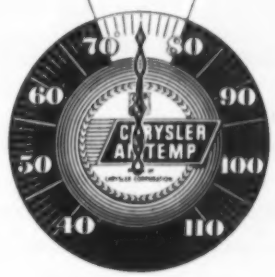

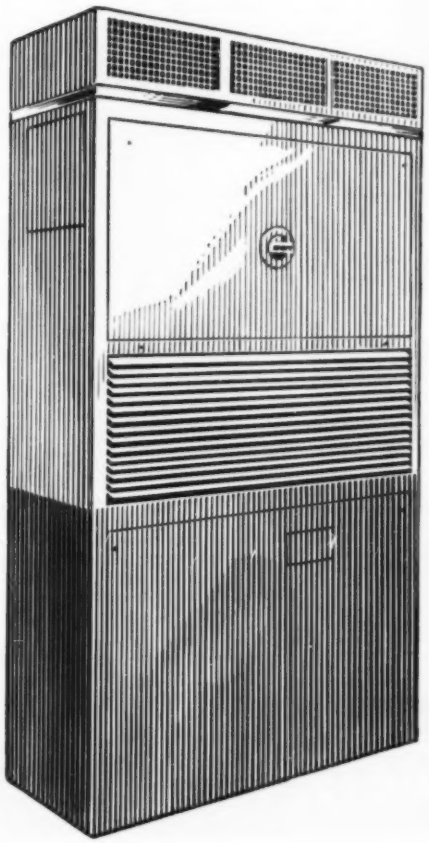

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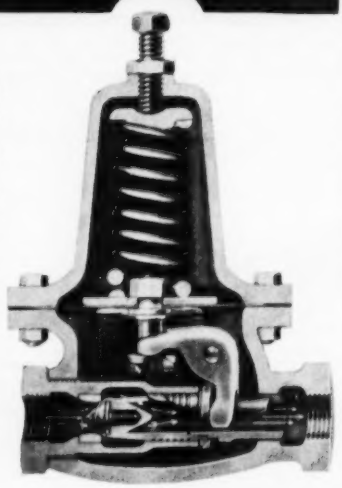

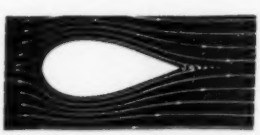

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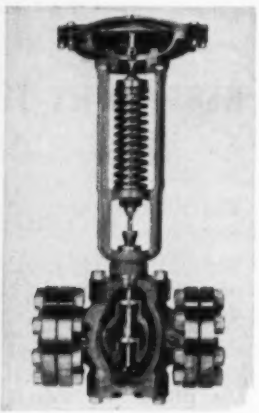

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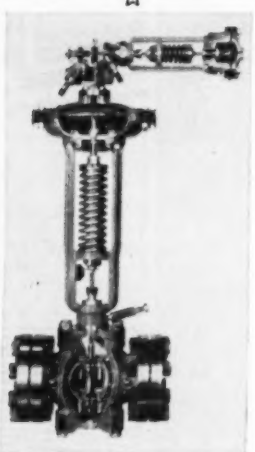

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THE GUIDE is unique — different — there is nothing like it! It is an indispensable tool — a ready reference volume for use when estimating and planning construction work. It is a "must" for engineers who need the technical data for design and calculation and writing specifications. Architects need it for coordinating heating, ventilating, and air conditioning design with their plans and specifications. Superintendents, factory engineers, operators, and managers of large structures, office buildings, schools, auditoriums, and institutions, all use THE GUIDE for help in their everyday problems.

TYPICAL SECTIONS

AIR CONDITIONING SYSTEMS: Equipment arrangement, and operation for year 'round air conditioning explained simply. Cost of owning and operating outlined. **AIR CONTAMINANTS:** Nature and control of contaminants in air discussed, and limits indicated. **AIR DISTRIBUTION:** Standards and methods for proper air distribution given. Formulas and charts included to aid in selection of outlets. **AIR DUCT DESIGN:** Includes ASHVE Air Friction Charts, together with basic formulas and tables for rectangular equivalents of round ducts and friction loss in elbows. Practical design for duct system illustrated. **CHIMNEYS:** Theory and actual operation of large and small chimneys considered. Formulas and charts for selecting residential chimney sizes included. **CODES:** Latest editions and sources of 145 codes and standards compiled for ready reference. **COOLING LOAD:** Weather design data for 316 localities listed. Solar heat gain tables included for glass, glass block, and figured rolled glass from ASHVE research. Simplified method shown for computing heat gain through walls and roofs. **DRYING SYSTEMS:** Theory and methods of drying outlined. Typical drying equipment illustrated. **FLUID FLOW:** Basic theory of fluid flow through pipes, nozzles, and orifices presented clearly and concisely. **FUELS, COMBUSTION, AND EQUIPMENT:** Gives properties of present-day fuels and their combustion data. Adjustment and operation of fuel-burning equipment explained. **HEAT LOSS CALCULATIONS:** Includes basic formulas and extensive tables for determining building heat loss for typical construction. Weather design conditions given for U. S. and Canadian cities. **HEAT TRANSFER:** Basic formulas applying to heat transfer by conduction, convection, and radiation are developed. Unit conductances for thermal convection for various surfaces are tabulated. Net radiation solutions for various relative positions of surfaces are given. **HEATING SYSTEMS:** Various types of steam, hot water, panel, warm air, and all-year comfort systems described. Data for determination of pipe and duct sizes. **INDUSTRIAL AIR CONDITIONING:** Design conditions given for manufacturing large number of products. **INDUSTRIAL EXHAUST SYSTEMS:** Data given for design of hoods, ducts and complete systems. **INSTRUMENTS:** Outlines methods of measurement and instruments used in heating, ventilating and air conditioning. **PANEL HEATING:** A simple method for design of panel heating systems, including snow melting. **PHYSIOLOGICAL REACTIONS:** Basic data and standards for comfort, explains reaction of human beings to atmospheric environment outside comfort range. Includes ASHVE Comfort Chart. Shows value of air conditioning in prevention and treatment of disease. **REFRIGERATION:** Simple presentation of different refrigeration cycles, types and functions of equipment, and controls. Outlines factors affecting use of the heat pump. **THERMODYNAMICS:** Simple discussion of thermodynamics in air conditioning, with illustrative problems showing use of ASHVE Psychrometric Chart and tables of properties of air from −160 F to +200 F. **WARM AIR SYSTEMS:** Design of gravity and forced circulation systems simplified by use of tables. Small duct, perimeter and ceiling panel systems described. **WATER SERVICES:** Shows how to determine service water demand, pipe sizes for cold and hot water systems, for cooling towers and for refrigeration. Gives data for selection of heater and storage tank capacity.

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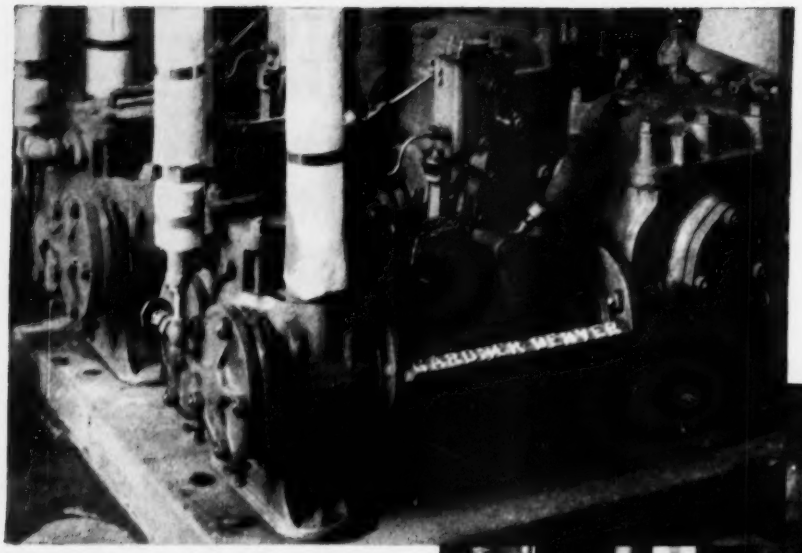
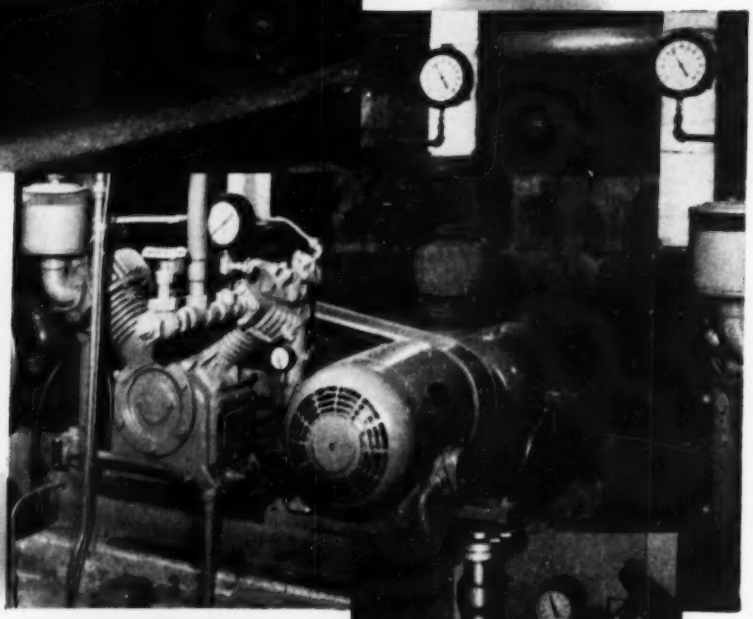
HP



STEAM PUMPS

for boilerfeed, processing and liquid transfer service.

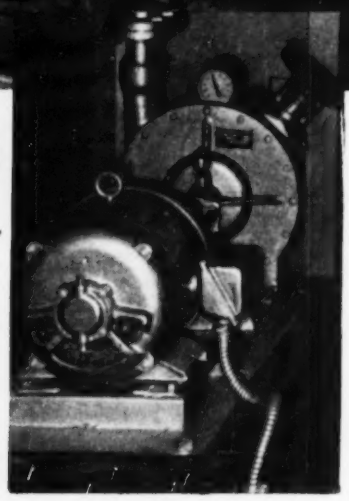


AIR-COOLED COMPRESSORS

for sprinkler systems, soot blowing and general compressed air supply.

CENTRIFUGAL PUMPS

for hot or chill water circulation, water supply and other pumping services.



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SINCE 1859

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois

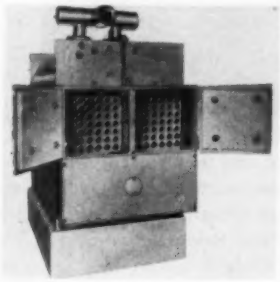
THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

[Continued from page 220]

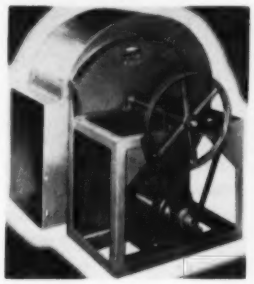
have been changed for greater efficiency. Chassis are interchangeable between the 1/3 and 1/2-ton units and between the 3/4 and 1-ton models. [Manufacturer: Fedders-Quigan Corp., 57 Tonawanda St., Buffalo 7.]

Split Sectional Boiler

HPAC 18*—Oil or gas fired Type "C" boiler split down the middle to fit through undersized door openings. . . . Designed to eliminate alterations, the steel boiler is bolted up on the job, with return and feed headers supplied. Tubes are accessible through front flue door. Available in 12 sizes with 876,000 to 5,100,000 Btu hourly. Steam radiation ranges from 3650 to 21,250 sq ft and water radiation ranges from 5840 to 34,000 sq ft. [Manufacturer: Portmar Boiler Co., Inc., 193 Seventh St., Brooklyn 15, N.Y.]



Boiler



Blower

Belt Drive Centrifugal Blower

HPAC 19*—Centrifugal blower with adjustable motor pulley to change speed. . . . A ready-to-install unit, it is convertible for installation at eight angles of discharge. The blowers are available in clockwise or counterclockwise rotation, have an overhung wheel and V-belt. Wheel diameters range from 9 in. to 30 in. Standard motors are open type single-phase capacitor-induction run or three-phase induction run. Other motors can be furnished. [Manufacturer: Hartzell Propeller Fan Co., P.O. Box 909, Roosevelt Ave., Piqua, Ohio.]

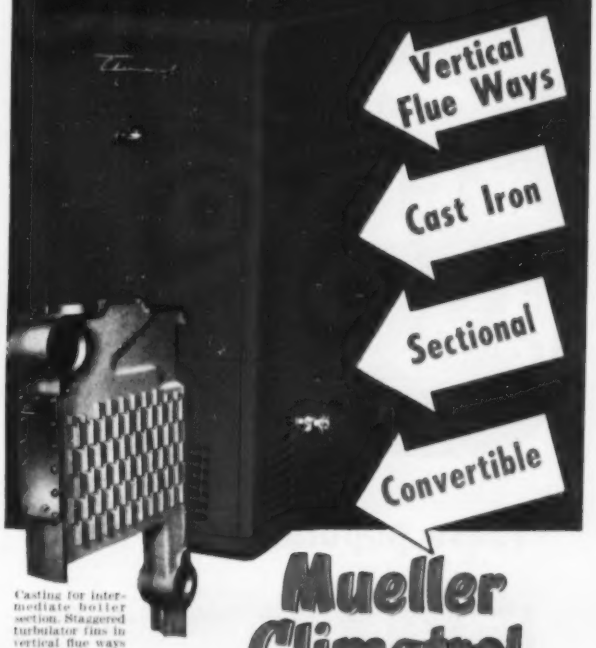
Weather Recorder

HPAC 20—New application for "Metameter Telemeter" in taking remote readings of atmospheric temperature in connection with weather observation. . . . Temperatures are measured at the remote point and the readings transmitted over a pair of telephone wires to a recording receiving instrument located at the observation site. The recorder chart tells the observer what the temperature is at the remote point, what it has been for the past several hours and its trend. [Manufacturer: The Bristol Co., P. O. Box 1790, Waterbury 20, Conn.]

Refrigeration Dessicant

HPAC 21*—Drier for high liquid line temperatures. . . . "Permagran" consists of anhydrous calcium sulfate processed so that each granule is hardened to a degree where it resists powdering while maintaining its absorption qualities. Under test it has withstood large quantities of water, extreme acid conditions, liquid additives and high liquid line temperatures. The new dessicant is supplied in driers and moisture control units. Various uniform mesh sizes

NEW Oil Boiler
for added business



Casting for intermediate boiler section. Staggered turbulator fins in vertical flue ways swirl rising flue gases for faster, more efficient heat transfer.

Mueller Climatrol

with Outstanding Design Features

- Wide size range for steam, hot water, and hot water supply — inputs of 240,000 Btu to 560,000 Btu. Staggered fins in flue ways turbulate rising gases for greater heat transfer.
- Precision - machined nipple ports and gas-tight vertical flue passages.
- Modern, attractive styling. Easily cleaned from the top without removing casing. Enclosed controls. Casing can be assembled to boiler after boiler is installed and piped.
- Triple tested. Assembled at factory for hydrostatic testing at high pressure and for correct fit. Knocked down for shipment. Conforms to A.S.M.E. code.
- Equipped with Mueller's efficient oil burner which provides efficient combustion, trouble-free operation. A sturdy burner —quiet, vibrationless.

Here it is — an oil-fired boiler with the same superb quality, easy installation features, and money-saving efficiency as the Mueller Climatrol gas-fired boilers.

It's the new Type 35 for steam or hot water; heavy cast iron, sectional, wet nipple boiler — available with tankless heater or can be used for direct hot water supply.

The Type 35 is in a special size range for those larger residential jobs, apartments, small factories, stores — in fact any installation requiring from 240,000 to 560,000 Btu input.

Because the Type 35 is easily converted to gas, it is a perfect answer for areas where people want gas but gas is not now available. Because it is shipped "knocked down", it is easy to get in any basement. Because it has been assembled and "triple tested", you are sure of a low cost installation and long life satisfaction.

Get complete details on the new Mueller oil boiler now. Use the Type 35 on your next job—convince yourself that the Type 35 is a better boiler.

Mail Coupon Today! E-57

Get the whole story

L. J. Mueller Furnace Company
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Send me facts and figures — including complete specifications — on your new Type 35 oil-fired boiler.
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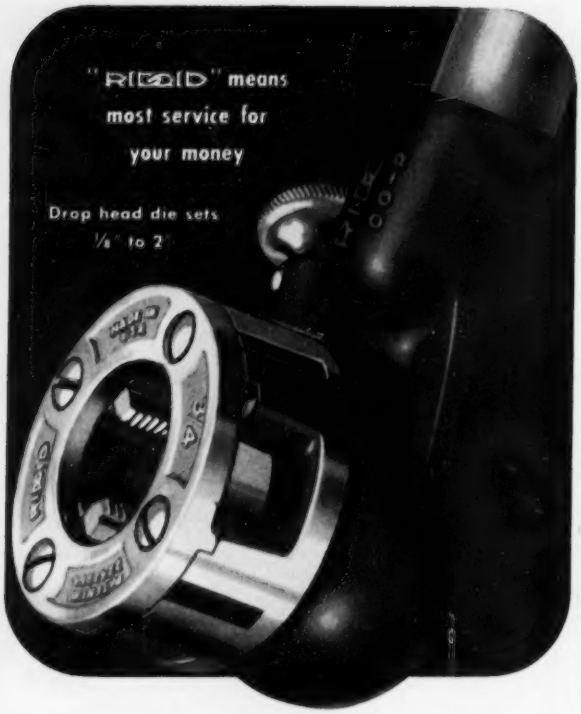
96th Anniversary

FOR GAS ★ FOR OIL ★ FOR COAL



These popular extra-handy

RIDGID

drop head dies

give you clean threads fast and easily

★ Small, well balanced, clean cutting, these popular RIDGID ratchet threaders are a pleasure to work with. They save you time and effort because heads snap into drive ring from either side, won't fall out. Precision-cut alloy dies reverse for close-to-wall threads — no special dies needed.

★ 00R and 0R, ⅛" to 1"; 111R and 11R, ⅛" to 1¼"; 12R, ⅛" to 2". Conduit dies, too—and free carrier with sets. Buy them at your Supply House.

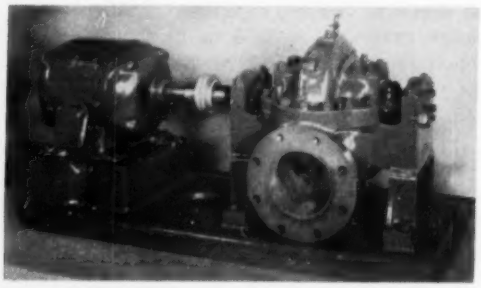
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

of "Permagran" are used according to the drier size. [Manufacturer: McIntire Connector Co., Livingston, N. J.]

Centrifugal Pump Series

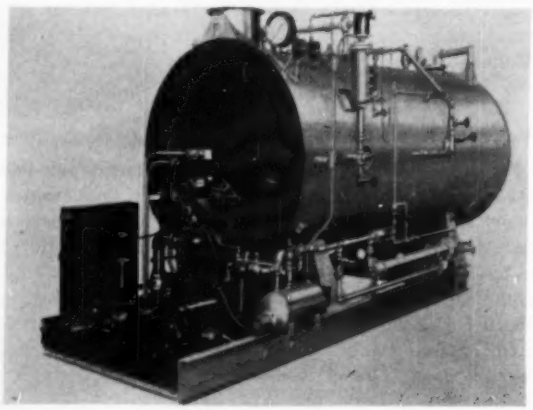
HPAC 22—New series of single stage, double suction centrifugal pumps known as "Fig. 3405" pumps. . . . Standard features on all include renewable stuffing box bushings, sealed bearing housings, cowl-type glands suitable for use with quenching liquids, stainless steel impeller keys, "Teflon" water seal rings, die-formed stuffing box packing and corrosion-resistant gland bolts. The pump



casings are horizontally split and removal of the upper half permits inspection, maintenance and removal of the entire rotating element without disturbing the suction and discharge piping, or pump and driver alignment. The pumps can be supplied with electric motor, belt or steam turbine drives. Capacities range from 200 gpm to 6400 gpm, with heads up to 260 ft. [Manufacturer: Goulds Pumps, Inc., Dept. HP, Seneca Falls, N. Y.]

Combination Gas and Oil Burner

HPAC 23—Combination boiler features quick changeover from gas to oil or vice versa. . . . The boiler operates on gas with the oil burner in place. No mechanical or electrical change is necessary. By flipping a selector switch

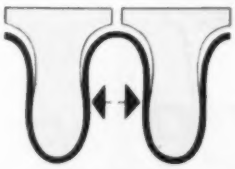


on the control panel to either gas or oil, the proper circuit is set into action. Turning fuel supply valves completes the changeover within 10 seconds. [Manufacturer: Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12.]

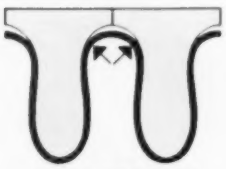
Console Air Conditioner

HPAC 24**—Water-cooled air conditioner for rooms without windows or with casement window construction . . . A ¾ hp unit, the "Roomaster," is 28 in. high, 20 in. wide and 19 in. deep. It is mounted on wheels to permit

STARTING POSITION
(Line Cold)



MIDDLE POSTION
(Line Heating Up)



FINAL POSITION
(Full Temperature)

directed flexing is the better buy!

Granted this is a rather abrupt and sure statement, yet we believe you will agree with it once you fully understand what Directed Flexing is and how it smooths out joint action, produces the ideal flexing movement, protects against over concentrated stresses . . . all of which make for long joint life.

Two design features are linked with the Directed Flexing feature. In fact, they are responsible for it.

1 the all-curve corrugation

2 the matching shape of the equalizing rings

Note how the corrugation when flexing under the force of the line movement uses the side surfaces of the adjacent rings as a guide. Instead of moving more or less as a flat plane, as would a straight sided corrugation, it actually wraps itself around the ring, contacting it progressively from bottom to near the top, reversing itself when the line cools off. This action not only distributes flexing stresses. It smooths out the movement. The equalizing rings, essential to this action, serve in another important way. They progressively control and limit the traverse on all corrugations.

This, in a nut shell, is the engineering back of the Badger Directed Flexing feature. If you will give a moment's thought to the stresses set up in a joint by a pipe line movement, you, too, will give full weight to the value of the Directed Flexing design of these expansion joints. You, like countless others, will see that Badger Expansion Joints will go onto your lines.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

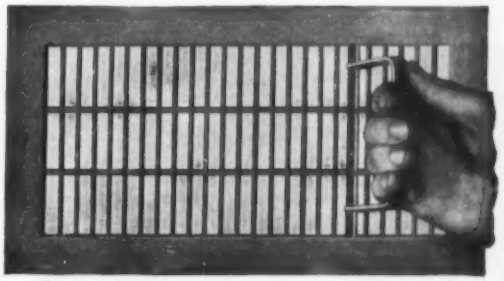
230 BENT STREET • CAMBRIDGE • MASS.

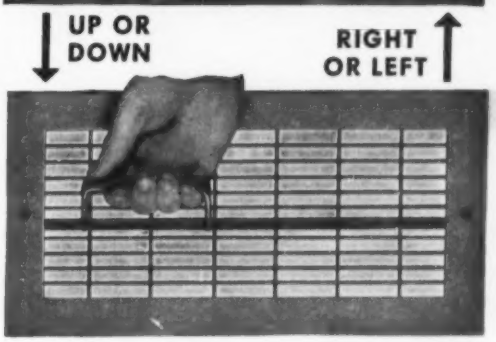
INDEPENDENT

"Fabrikated" WALL GRILLES for Commercial Installations

PROVIDE ADJUSTABLE DIRECTED AIR FLOW

321-A





311-A

Made to fit openings in even inches from 8″ x 4″ to 60″ x 40″

Independent Fabrikated* Adjustable Grilles (patented), rigidly constructed with stamped steel rims and steel bars, are made with either vertical or horizontal grille bars. Grille bars are *adjustable* before or after installation; available also with bars permanently set for straight flow.

Write for new Catalog No. 52—gives schedule of sizes, details and prices.

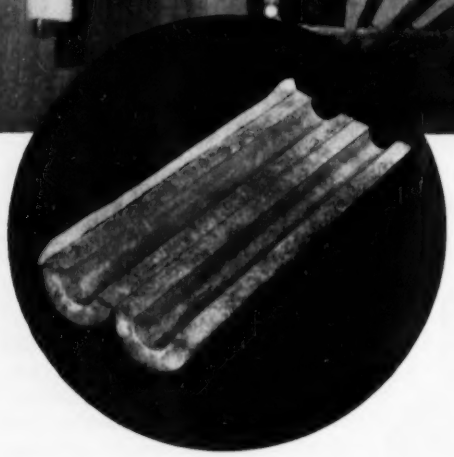
Always Leading — Always Progressing

*Reg. U. S. Pat. Off.

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET · CLEVELAND, OHIO

take a long look at the insulation you never have to look after.... Amocel



That's right! Unarco Amocel is as maintenance-free as an insulation can be—light, strong, durable ,efficient. It's unharmed by moisture, steam, fumes; withstands impact and vibration; may be removed and reused repeatedly without damage or efficiency-loss.

Amocel, a Unarco exclusive, brings to commercial insulation applications many of the excellent features already made famous by Unarco Unibestos—the higher-temperature stand-out. You'll like its easy installation, its clean appearance, its year-after-year effectiveness.

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INDUSTRIAL Insulations

PRODUCTS OF

UNION ASBESTOS & RUBBER COMPANY

easy storage during off seasons. [Manufacturer: Ajax Corp. of America, 2509 Washington Ave., Evansville, Ind.]

Flexible Tubing for Air Handling

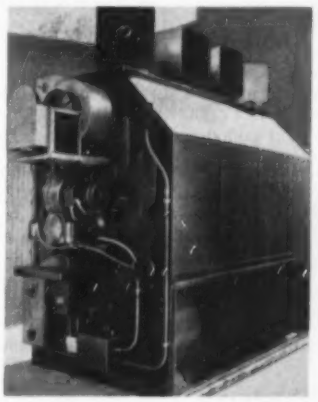
HPAC 25—Low-cost tubing for use in air handling, fume removal, and dust collection. . . . The tubing, which can be used in exhaust, blowing or gravity systems, is made of a rust-resistant wire helix covered with high-count woven fabric coated with a resinous compound. Known as "Flexflyte Green Label," it is flame resistant and has good resistance to oils, gases, acids, alkalis and abrasion. It is produced in 50-ft lengths and in diameters from 1 to 2½ in. [Manufacturer: Flexible Tubing Corp., Guilford, Conn.]

Industrial Heater

HPAC 26*—Improved line of industrial heaters for large areas which cannot be heated by other methods. . . . Self-contained units, which range from 100,000 to 2,500,000 Btu per hr in heating capacity and from 2000 to 25,000 cfm in air volume, may be floor, wall or ceiling mounted. They may be mounted in either upright or inverted positions when wall mounted. The new line includes a heavy duty model designed especially for steel, rubber and paper mills. Accessories available include filter boxes for built-in mechanical air cleaning and air-mixing boxes for controlled mixing of fresh and recirculated air. [Manufacturer: Westinghouse Electric Corp., Sturtevant Div., Dept. T-535, 200 Readville St., Hyde Park, Boston 36.]

Heating Units

HPAC 27—Series of self-contained, automatically operated heating units designed for industrial and commercial construction. . . . Model "H" is available in 12 sizes ranging in output from 200,000 to 2,000,000 Btu. Four-way heat discharge heads and floor line return air grilles provide working level comfort by controlling the direction

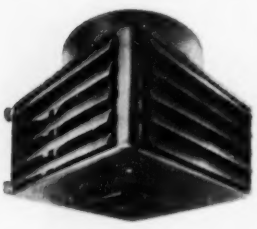


and extent of heated air circulation. Design of the heat exchangers of the unit utilizes the direct flame-metal-air principle of heat transfer for maximum efficiency. Units are designed for light oil, heavy oil, gas or combination gas-oil firing. [Manufacturer: National Heater Co., 2182 Cleora Ave., St. Paul 4.]

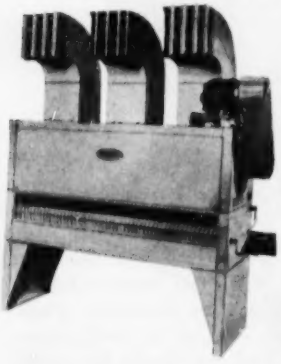
There's a bonus built into this Carrier heater

Good looking, quiet, rugged, this Carrier propeller-fan type horizontal discharge Unit Heater is ideal for a wide variety of applications, delivering warmed air from heights of 15 to 18 feet. It's available in 10 sizes, 21,000 to 200,000 Btu's. For steam or hot water. ***And there's a bonus.*** Its single-row Aerofin heating coil with widely spaced fins offers less air resistance than ordinary heaters, makes cleaning much easier. Carrier design gives you quicker, more efficient, cleaner heat. Carrier Corporation, Syracuse, N.Y.

Any size space can be heated economically with Carrier heating equipment



Carrier propeller-fan type Unit Heaters. Besides the horizontal model, there's a four-way Directed-flo vertical model (left) which gives quick heat from higher ceilings, discharges warmed air in 4 directions, for steam or hot water, in 7 sizes from 82,000 Btu's. And a gas-fired model with one-piece heat exchanger and combustion chamber of Aluminized Steel, AGA approved for all gases, in 7 sizes from 70,000 Btu's (there's a duct type gas-fired model, too).



Carrier blower type Heat Diffusers. For heating and ventilating larger enclosed areas. Floor, wall or ceiling mounted, sectionalized for easy rearrangement. In 6 sizes to 2,390,000 Btu's per hr. at 2-lb. steam. Air handling capacities to 31,000 cfm. Steam or hot water.

Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

WE HEAR THAT . . .

A program of scholarship awards for the sons and daughters of employees has been announced by *HANDY & HARMAN*, refiners and fabricators of precious metals and their alloys. The awards, based on scholastic record, character and financial need, will apply to a college or university and will cover tuition fees and part of the living costs.

A four-week training program for student heating engineers is being conducted in the Johnstown, Pa. general offices of the *NATIONAL RADIATOR CO.* The training program in basic heating engineering began on February 16. Diplomas certifying completion of the heating engineering course will be presented on March 18 during the initial session of the company's heating division general sales conference.

NORMAN J. GOULD, president of *GOULDS PUMPS INC.*, of Seneca Falls, N.Y. has been awarded the 1952 Merit Award given by Radio Station WGVA, Geneva, N.Y. The award was presented to Mr. Gould to honor his outstanding civic leadership.

A new series of traveling educational shows covering the function and operation of heating and refrigeration controls is being sponsored by *PENN CONTROLS, INC.* Scheduled to begin in Albuquerque on March 2 and travel through several western states, the shows were created to give visual demonstration in the use, construction, installation and servicing of automatic controls. Meetings are being arranged in each city by local jobbers of Penn Controls.

AIR-MAZE CORP. has announced the opening of its new plant and general offices at 25000 Miles Road, Cleveland 28. It is located on 30 acres of ground and the plant itself has over 150,000 sq ft of floor space.

The board of directors of *SALL MOUNTAIN CO.* announce the resignation of *FRANK R. ANDERSON.* Mr. Anderson is retiring from business after 40 years of service with the firm. He had served as vice president in charge of sales.

WILLIAM G. CHRISTY, until recently director of the Bureau of Smoke Control in New York, now is a consulting engineer with offices at 34 Park Row, New York. Active in this field for many years, he will specialize in problems of air pollution control, combustion, fuel and refuse burning, and smoke control.

What has been known as the Heating Control Div. of *IRON FIREMAN MFG. CO.* now will be designated the Electronics Div. Division manager is *WAYNE STRONG.*

CHARLES KNOX, vice president and works manager of Baker Refrigeration Corp., has been elected to life membership in the *AMERICAN SOCIETY of REFRIGER-*

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OIL BURNER IGNITION WIRE

THERMOSTAT CABLE

TW WIRE

INSTRUMENT WIRE

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-for safety and dependability beyond specification

OK

CHESTER makes them all!

- JAN-C-76 APPROVED WIRES
- 80-90-105°C HOOK-UP WIRE
- SHIELDED WIRE AND CABLE
- FLEXIBLE CORDS
- COAXIAL CABLE
- TELEVISION LEAD IN CABLE
- GAS TUBE HIGH TENSION CABLE
- OIL BURNER IGNITION CABLE
- BLASTING WIRE
- TELEPHONE WIRE
- THERMOSTAT CABLE
- BELL AND OFFICE WIRE
- TW BUILDING AND FIXTURE WIRE

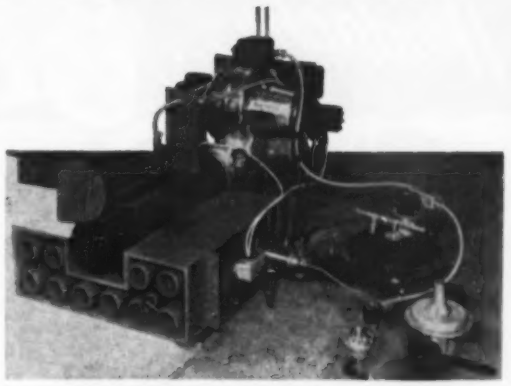
All Chester wire and cable features the extra dependability, long service life and easier working qualities of plastic insulation. Their tough, impervious plastic coats provide maximum immunity to abrasion, weather, oil and most chemicals. They are smooth, pull through conduit with minimum effort and present a fine appearance in exposed locations.

There's a Chester single or multi-conductor wire or cable for practically every indoor or outdoor requirement including many special constructions for the electrical, electronic, TV, radio, telephone and other industries. Why not write today for full information?

CHESTER CABLE CORP.
CHESTER, NEW YORK

MANUFACTURERS OF QUALITY WIRE AND CABLE FOR EVERY ELECTRICAL AND ELECTRONIC REQUIREMENT

WEBSTER DUONETIC*
for Dual Fuel Firing



The WEBSTER DUONETIC* now offers unsurpassed economy, efficiency and trouble-free operation in the combination oil and gas firing equipment field. Never before have both fuels been burned so well so simply.

You can rely on the usual WEBSTER quality to provide you with the best.

Both burners employ electric ignition; constant electric ignition on the oil burner, and electric ignition for the gas burner safety pilot.

•

WEBSTER KINETIC* BURNER

For Low Pressure Gas

The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louver. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired.

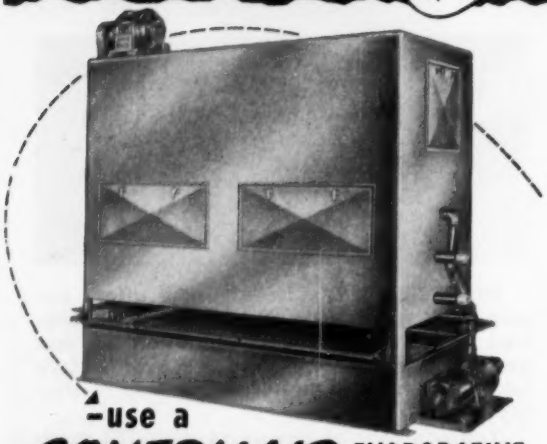
As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series 88 Bulletins.

* TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

When water is a *Headache...*



-use a **GOVERNAIR** EVAPORATIVE CONDENSER

Water supply for air conditioning *can* cause you a lot of trouble. When there's a shortage; when rates are expensive or when sewage and piping are impractical—*water becomes a real headache!*

That's when engineers and contractors alike turn to Governair Evaporative Condensers!

Governair Evaporative Condensers eliminate waste-water disposal problems and pumping costs. And they're engineered to give maximum efficiency and performance at a reasonable cost. Available in sizes from 3 to 100 tons.

Choose a Governair Evaporative Condenser and there's no need for aspirin! GOVERNAIR CORPORATION, 513 N. BLACKWELDER, OKLAHOMA CITY, OKLA.

GOVERNAIR

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

ATING ENGINEERS, having been a member in good standing for a period of 30 years. Mr. Knox has been with the Baker organization for 42 years.

PAUL J. UTNEHMER, works manager, Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa. received the award "Man of the Year" from the Beaver Falls Junior Chamber of Commerce. Mr. Utnehmer was cited for the "humanitarian work and civic effort" put forth by him during the year.

A new series of film strips on arc welding for use by instructors to introduce students to the welding process, welding equipment and where and how it is used, now is available through the *LINCOLN ELECTRIC CO.* of Cleveland. The series of three strips, produced in color with a supplementary manual, is designed for the instruction of high school students, vocational trainees, and technical apprentices. The series, called "Arc Welding," consists of three 50-frame strips, "Electric Arc Welding and How it Helps Man," "Selecting and Using Arc Welding Equipment Safety," and "Practicing Arc Welding."

The engineering facilities of the Piping Design Div. of *MARQUETTE COPPERSMITHING CO.* in Philadelphia have been expanded recently to provide for a limited number of additional design projects. This division specializes in design and stress analysis of single and multi-planar space piping systems.

BITUMINOUS COAL RESEARCH, INC. has announced plans for arranging combustion conferences for groups of power engineers, plant engineers, consulting engineers and others in coal consuming markets. Speakers are being made available and talks, slides and explanatory models have been prepared on several subjects. Subjects to be discussed include smoke problems caused by deficiencies in overfire air and turbulence in industrial and commercial boiler furnaces, problems relating to combustion, such as coal and ash handling, combustion control, fly ash collection, and good engineering for coal-burning plants. The meetings, conducted by engineers of the coal industry, can be sponsored by local groups. Further information is available from Charles H. Marks, Bituminous Coal Research, Inc., 488 W. Sixth Ave., Columbus 1, Ohio.

When contractors and dealers need only a few feet more of insulation than a standard package holds, *INFRA INSULATION, INC.* of New York now offers an additional, new size carton, for Infra Types 6H and 4H-16. It now packs 100 sq ft as well as 1000, 500 and 250 sq ft.

Expanded facilities for the manufacture of silicone materials to meet increasing industrial demands, recently were opened at the *GENERAL ELECTRIC CO.'s* silicone chemical plant at Waterford, N.Y. The present $5 million expansion program and planned future expansion will ready the company for an expected tenfold increase in total industry demand for all silicone products by 1960.

A new two-story modernistic building constructed almost

for • SPRAYING
• WASHING
• RINSING
• COOLING
• AIR CONDITIONING

YARWAY

SPRAY NOZZLES

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for new Bulletin N-616.

YARNALL-WARING COMPANY
107 Mermaid Avenue Philadelphia 18, Pa.

For all three

1 ECONOMY
2 PERFORMANCE
3 COMPACTNESS

CARVER Model B ELECTROPUMPS

- Mechanical Shaft Seals
- Stainless Steel Shafts
- Enclosed Bronze Impellers
- Rotatable Volute Casings
- Grease-Sealed Heavy-Duty Ball Bearings
- Top Quality Motors
- Capacities up to 70 GPM Heads up to 110 Feet
- Two Sizes: 1" and 1¼" Discharge

CARVER introduces a brand new line of small end-suction centrifugal pumps designed to efficiently and economically solve your pumping problems.

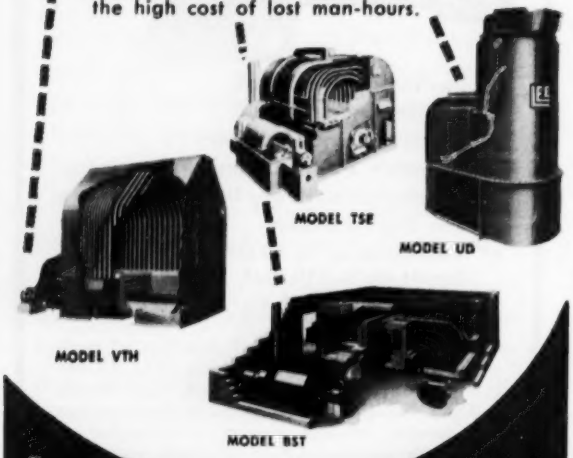
These versatile Carver Model B Electropumps are durable, efficient pumps, close-coupled to high-grade continuous-duty, jet pump motors of standard NEMA dimensions. Though compact in size, and very reasonable in cost, they are built for continuous hard service and backed by CARVER'S one year guarantee. Your best buy for better performance in every way.

Carver's broad line of centrifugal pumps includes many sizes and types (end suction, split case, self priming) in capacities up to 4200 GPM, pressures up to 135 pounds.

Ask for Bulletin No. 211

CARVER PUMP COMPANY
1460 Hershey Ave., Muscatine, Iowa

CARVER PUMPS

look to LEE
direct-fired heaters for industry to help
HEATERS SINCE 1918
INCREASE EFFICIENCY and PROFIT
brings comfort to workers . . . reduces absenteeism
Uneven temperatures cause discomfort, sickness, disgruntled workers, lower efficiency, reduced work output and especially absenteeism.
Winter and summer, you can depend on Lee completely engineered heaters to efficiently keep your plant at even-temperatures with balanced air. Avoid drafty, turbulent air carrying-dirt and dust, causing work spoilage, damaged products and the high cost of lost man-hours.


a direct service of LEE
Lee Corporation maintains complete engineering service in all major branches of engineering:
• ELECTRICAL • MECHANICAL • POWER HOUSE
• STRUCTURAL • BOILER ROOM • DESIGN
• HEATING AND VENTILATING
SPECIFY LEE The completely engineered heater
LEE CORPORATION
1011 TATNALL STREET
Wilmington, Delaware
Baltimore, Md. Chicago, Ill. New York, N. Y.
HEATERS SINCE 1918 Representatives in all principal cities

entirely of stainless steel and glass has just been erected by *EDWARD VALVES, INC.*, at East Chicago, Ind. Four-fifths of the buliding area is devoted to a giant drafting room. Built for the use of the engineering department, it is air conditioned throughout and is of fireproof construction. All floors have been fully ducted to provide for expansion of utilities.

An automatic, air and hydraulically actuated test stand for determining the physical characteristics of seamed tubing up to 3 in. in diameter has been developed by the *DOMMERS CO.* According to the manufacturer, test specimens of steel, stainless steel and carbon steel tubing can be checked for flaring, column and crushing strength with pressures up to 100,000 lb.

NATHAN EDELSTEIN has resigned as executive vice president of the *REFRIGERATION AND AIR CONDITIONING CONTRACTORS ASSOC.* Mr. Edelstein continues as executive vice president and general counsel for the Refrigeration & Air Conditioning Guild, Inc. of New York. *EDNA BERGGREN* has been appointed executive secretary of the refrigeration association with headquarters in Chicago. She has been executive secretary of the Chicago chapter since 1949.

ZECHARIAH CHAFEE, JR., chairman of the board of directors of *BUILDERS IRON FOUNDRY* and *BUILDERS-PROVIDENCE, INC.*, recently was presented with an award after completing 40 years of service with B-I-F Industries. Three other members to receive 40-year awards were *ALAN A. WOOD*, and *ANTONIO* and *RICARDO DEBERADIS*.

A new insulation against heat, with potential applications in fields where heat and limited insulation space are factors, is under development at the *GENERAL ELECTRIC RESEARCH LABORATORY*. The announcement was made by *DR. C. G. SUITS*, vice president and director of research. The company claims that the new insulation is 10 times as efficient as any now in use and, as a possible future development, walls of only ½ in. thickness may be needed in refrigerators and freezers.

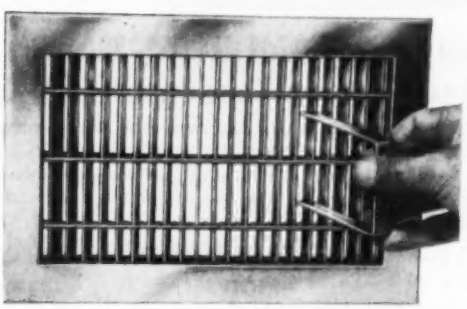
TRION, INC. is introducing a new air filter tester, built to National Bureau of Standards specifications, which may be used to measure the efficiency of air filters on the job rather than in the laboratory. The apparatus consists of drawing samples of dirty and cleaned air through filter paper. The efficiency of a filter is determined by the amount of light transmitted through the filter paper and measured by photoelectric instruments. Known as the "Dill Dust-Spot Tester," the test methods were developed by *R. S. DILL* of the National Bureau of Standards and incorporated into the equipment perfected by *GEORGE LANDGRAF*, Trion's vice president in charge of engineering.

The *JOHN R. CASSELL CO.* of 110 W. 42nd St., New York 18, now is producing dimetric graph sheets. The

IN OUR SCHOOLS
REGISTERS and GRILLES
MUST BE
*Tamperproof
*Kickproof
Specify

R & G Solid Bars with
Interlocking Cross Bars
(Fixed or Adjustable)

*FAULTLESS OPERATION
*RUGGED CONSTRUCTION



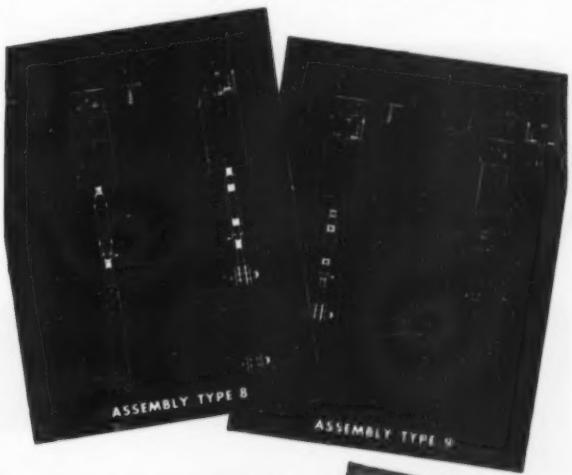
R & G Style 120 Chromium plated

Complete Line of Registers and Grilles for
HEATING • VENTILATING • AIR CONDITIONING
Catalog on Request

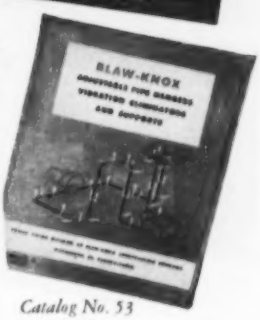
REGISTER & GRILLE MFG. CO., INC.
70 BERRY STREET, BROOKLYN 11, N. Y.

All Movements
Under Control
with

BLAW-KNOX OVERHEAD
ROLLER ASSEMBLIES



Type 9 Functional Assembly (illustrated) provides free rolling action in two directions and freedom of movement in three—lateral, vertical and horizontal. Its *internal swivel* action gives full control over all movements, and minimizes absorption of piping thrusts by the connecting flanges . . . a big help in keeping maintenance and replacement costs at rock bottom. Available for all standard size piping. Accommodates operating loads up to 12,000 lbs.



Catalog No. 53
on request.

POWER PIPING AND SPRINKLER DIVISION
BLAW-KNOX COMPANY
PITTSBURGH 33, PA.

BLAW-KNOX

plate is based on exact mathematical calculation. This is part of the "Instrumaster" line of isometric and dimetric ellipse stencils intended to promote axonometric drawing. The graph sheets are printed in "invisible" ink so that the lines may be followed when sketching but will not reproduce in blueprints or black and white prints. Samples are available if requested on business or professional stationery.

Last month *SERVEL, INC.* conducted two factory training schools for air conditioning distributor personnel who had not attended previous schools. The two courses offered were application-engineering and servicing.

A two-day national sales meeting was held recently by the Kathabar Air Conditioning Div. of *SURFACE COMBUSTION CORP.* in Toledo. Approximately 40 men from all parts of the United States and Canada attended the meeting conducted by *F. M. JOHNSON*, sales manager of the division.

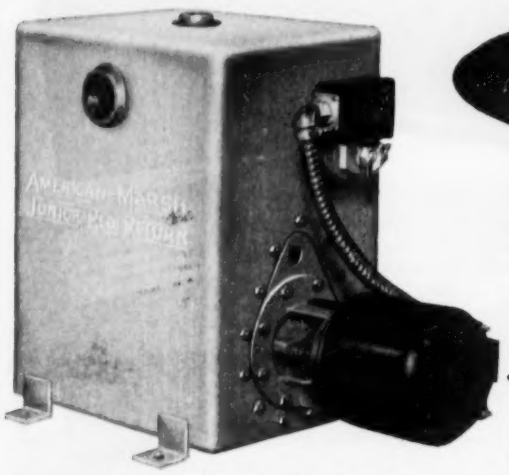
The *BABCOCK & WILCOX CO.* has purchased a tract of land south of the city of Wilmington, N.C. and has started construction of a $2 million plant to build boilers and related equipment. The property purchased is 153 acres and the building will be about 135,000 sq ft. In addition, there will be about 1500 ft of uncovered craneway. This is the seventh plant in the company's Boiler Div.

Formation of a general research organization for *OLIN INDUSTRIES, INC.*, has been announced by *DR. FRED OLSEN*, vice president for research and development. The organization will conduct basic research and work with all eight Olin manufacturing divisions on long range and specialized research problems and will coordinate the efforts of the company's various divisional research departments.

In preparation for the 1953 sales campaign, 23 key field and factory personnel of *CHRYSLER AIRTEMP* have completed a nine-day merchandising and sales course in Dayton. In addition, regional and home office sales personnel attended a three-day sales conference.

The *HAJOCA CORP.*, distributors of heating and plumbing, industrial and refrigeration supplies, will offer a complete line of refrigeration equipment to the refrigeration and air conditioning trade in the Tampa area through a new department recently opened at its branch office in Tampa, Fla. The corporation now carries refrigeration materials in 11 of its 33 branches that serve the Atlantic Coast area from Newark to Tampa.

The one-millionth motor since the opening of the plant in 1946 has come off the line at the Buffalo, N.Y., Motor and Control Div. of the *WESTINGHOUSE ELECTRIC CORP.* Completion of the motor, a 7½ hp "Life-Line" model, culminated production of 10,009,292 hp of capacity in electric motors.



SIZE 1—To 5,000 sq. ft. radiation at 20 lbs. discharge pressure—18,000 sq. ft. at 8 lbs. pressure.

SIZE 2—To 9,000 sq. ft. radiation at 30 lbs. discharge pressure—18,000 sq. ft. at 20 lbs. pressure.

AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN
In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

7 TIME-TESTED FEATURES PUT YOU AHEAD

when you install AMERICAN-MARSH Junior Redi-Return Condensation Units

You're *'way* ahead when you *please* the "man who pays the bills." To be *sure,* install this Junior Redi-Return Condensation Unit. Well designed—rightly priced—it gives low-cost, trouble-free service in hotel, store, school and apartment heating systems. These time-tested "Junior" features show why:

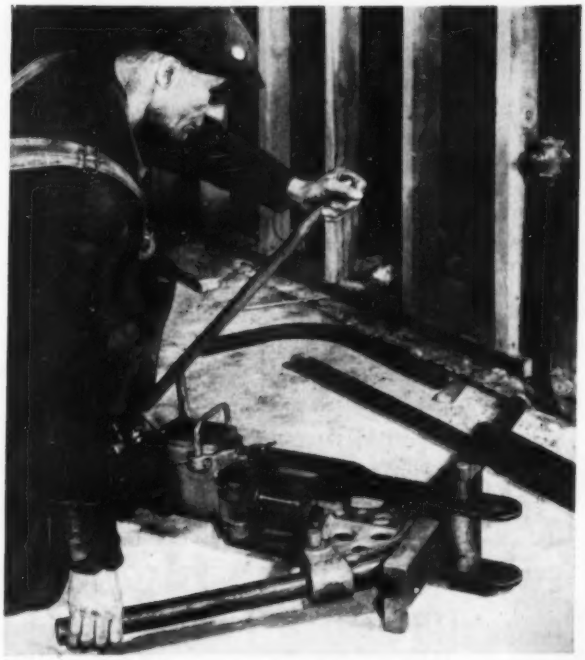
1. Bronze-fitted pump—balanced, enclosed bronze impeller.
2. Pump is inside tank—saves floor space.
3. Easy to install—no special foundation.
4. Remove working parts from tank without disturbing pipe connections.
5. No lubrication ever needed.
6. Heavy, 16 gallon copper-bearing steel tank—high and low inlets.
7. Drip-proof ball-bearing capacitor motor—heavy-duty float switch.

And there's more—we'll gladly supply full performance data, dimensions and details . . . Write for Junior Redi-Return Bulletin 425.

Pumps and Pumps Only Since 1873

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC

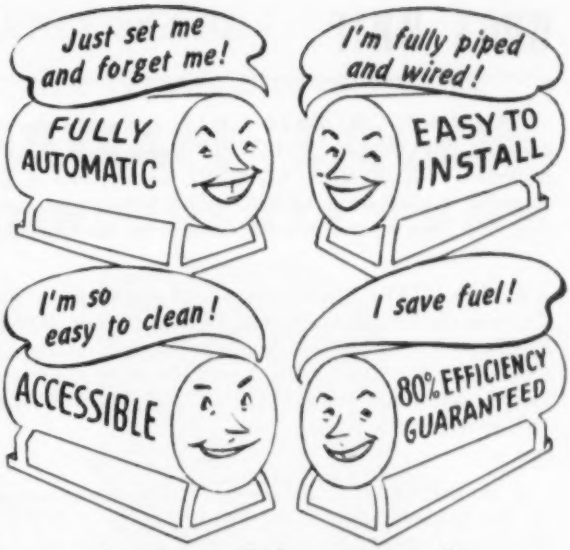
RADIANT HEATING PIPE
BENT QUICKLY, ACCURATELY
WITH GREENLEE PIPE BENDER



Install radiant heating pipe the timesaving, accurate way . . . with the GREENLEE 770-R Hydraulic Pipe Bender. With it one man *in a few minutes* can make 90° and return bends in *cold* pipe of sizes ½", ¾", 1", 1¼", 1½" and 2". Operation is simple, quick. The GREENLEE is compact, portable . . . easy to carry, set up and operate exactly where and when needed. And it is specially designed to produce *accurate duplicate bends* so that the entire series of bends has smooth uniformity throughout. Do the job easier, faster, *better* with a GREENLEE Bender. Write for free Bender booklet.

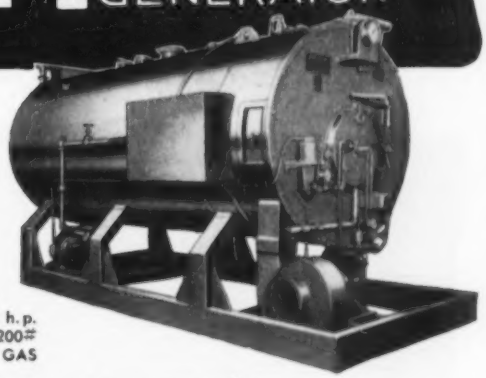
TOOLS FOR CRAFTSMEN
GREENLEE

Greenlee timesaving tools for plumbing and heating work . . . Hydraulic Pipe Benders • Tubing Benders • Hydraulic Pipe Pushers • Pipe Bits • Auger Bits • Spiral Screwdrivers • Chisels and many more. Write for details. Greenlee Tool Co., 2343 Twelfth Street, Rockford, Illinois.



— Just some of the reasons why so many users prefer

AMESTEAM GENERATOR



20 SIZES
10 to 600 h.p.
15 to 200#
OIL OR GAS

— and here are some others:

★ Eye-level controls — protected from dirt, water and accidental damage

★ AMES SERVICE — our **LOCAL** service man starts your unit and provides 3 months' FREE SERVICE

WRITE FOR THIS FREE BULLETIN ON CUTTING STEAM COSTS!

NAME .....

COMPANY .....

ADDRESS .....

AMES IRON WORKS INC.

BOX D-33 OSWEGO, N. Y.

Builders of Better Boilers since 1848

WHO'S WHAT

ILLINOIS ENGINEERING CO. has announced the retirement of *JAMES C. MATCHETT* as president and the re-election of *ROBERT L. GIFFORD*, a co-founder of the company, as president. *GORDON L. HARRIS*, vice president, has been elected general manager of the company.

RAY O. REEVES, sales manager of the Airtherm Mfg. Co., was elected president of the *CONVECTOR MANUFACTURERS ASSOC.* at a recent annual meeting in Cleveland. *W. R. McMAHON* of Modine Mfg. Co. was named vice president, and *GEORGE W. McCORMICK, JR.*, secretary-treasurer.

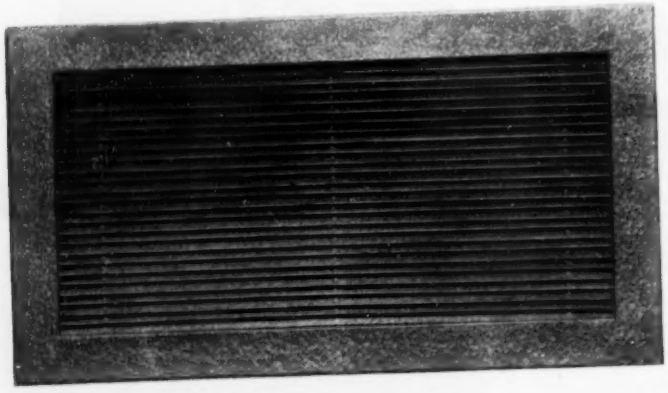
J. A. ROBINSON has been made field sales manager for the Industrial Div. of *MINNEAPOLIS-HONEYWELL REGULATOR CO.* He succeeds *O. B. WILSON*, who was recently named sales manager of industrial instruments. Mr. Robinson, who joined the company in 1929, will make his headquarters in Philadelphia.

SKIL CORP. has announced the appointment of *ROBERT P. MELIUS* as merchandising manager. He replaces *WILLIAM FERRY*, who has been named industrial sales manager. *JACK T. CARLSEN*, former industrial sales manager, will direct the company's newly formed sales training division. Mr. Melius had been with the Delta Power Tool Div. of Rockwell Mfg. Co. since 1930. Most recently he was vice president of sales.

ROBERT W. SAXTON has been appointed sales manager of the contract division of *KOLD-HOLD MFG. CO.* For the past six years he has been district sales supervisor for the U.S. Gypsum Co.

At the recent annual meeting of *THE ALUMINUM ASSOCIATION* in New York, *D. A. RHOADES*, vice president and general manager of Kaiser Aluminum & Chemical Corp., was elected president for the ensuing year. *A. V. DAVIS*, Aluminum Co. of America, was re-elected chairman of the board and *DONALD M. WHITE* was reappointed secretary and treasurer. Elected to serve as vice presidents of the association were: *S. D. DEN UYL*, Bohn Aluminum & Brass Corp.; *RAYMOND DEUTSCH*, Monarch Aluminum Mfg. Co., and *R. P. STRANAHAN*, Stranahan Foil Co., Inc. Elected as directors-at-large for three year terms were: *R. A. BLANCHARD*, Detroit Gasket & Mfg. Co., *A. P. COCHRAN*, Cochran Foil Co., and *R. G. TESSENDORF*, Aluminum Industries, Inc.

The appointment of three men to new sales positions has been announced by *MINNEAPOLIS-HONEYWELL REGULATOR CO. ELDON L. RICHARDSON*, for the past seven years manager of the company's Salt Lake City sales office, becomes supervisor of the new home market.



- CUTS INSTALLATION TIME OVER ½!
- EASY TO INSTALL *Anyone Can Do It!*
- COMPLETE—NO WOOD MOLDINGS TO ADD!

NEW! THIN CORE GRILLE FOR DOORS — PARTITIONS ¼" to ¾" THICK!

First Grille ever designed specifically for thin doors and partitions. Anyone can install it in just a few minutes time. No close tolerances required . . . almost a half-inch extra on sides for positioning. Telescoping auxiliary frame fastens to grille with posts and screws. Clamps tight. No holes to position. Practically no danger of ruining door. No wood moldings. All steel. Rattle-proof. No vision, with 80% free area. Available with or without frame, all sizes. Gray or tan prime coated, or Hammertone finish in gray or bronze.

→ ACTUAL SIZE Cross Section

WRITE FOR OUR COMPLETE **FREE CATALOG**
Listing Over 1000 Types and Sizes of Grilles for Every Requirement

A-J MANUFACTURING CO.
Dept. H3 - 2119 Washington St. - Kansas City, Mo.

M&L ...Traditionally
the right equipment for
every Water Heating purpose

When your plans include heating water with live or exhaust steam—when they call for hot water supply to radiant heating panels or other hot water systems—then use M & L equipment.

There are many reasons why M & L equipment is traditionally selected for dependable, uninterrupted service—one of which is the extreme care exercised in assembling, to insure longer service life.

Standardized Flexibility

The unique M & L method of fabrication, which permits custom-built equipment to be made from standardized components at a substantial saving in first cost—fits the equipment to the job to be done.

Send for more details on this worthwhile economy. Please include complete operating conditions in your inquiry to receive an accurate, individual proposal.

1954

Manning & Lewis Engineering Co.

32 Ogden Street Newark 4, New Jersey

SALES REPRESENTATIVES IN PRINCIPAL CITIES

ANNOUNCING—

The New Improved Design

EAGAN "EAGLE"
CONDENSATE PUMP

MATCH THIS FOR VALUE!
Here's the best condensate pump "buy" on today's market. It provides far more capacity than any similar pump . . . 8,000 sq. ft. EDR at 20 PSI . . . and it's only $124.00 (trade price, F.O.B. Phila.)

REDUCED PRICE

IMPROVED DESIGN

Compare These Six Features

- Low inlet, 2" I.P.S., 12" from floor
- All bronze centrifugal pump
- Standard ¼ HP 115 volt quiet capacitor motor
- Thermal overload protection
- Driplip base of heavy structural steel with ½" tapped drain
- Flexible connectors on both suction and discharge of pump, and flexible coupling isolate the pump, preventing pipe cramp and misalignment, which cause wear and noise

OTHER MODELS TO 100,000 SQ. FT. 200 P.S.I.

WALTER H. EAGAN CO., INC.

Mfgs. of Condensate, Vacuum, Turbine, Boiler Feed and Centrifugal Pumps.
Pump Specialists since 1920

WALTER H. EAGAN CO., Inc. (Dept. B) MAIL COUPON TODAY
2336 Fairmount Avenue
Philadelphia 30, Pa.

SEND ME FREE DESCRIPTIVE BULLETIN OF THE NEW EAGAN "EAGLE" CONDENSATE PUMP

NAME .....
COMPANY .....
STREET .....
CITY ..... Zone .... State .....

MEASURE AIR VELOCITY DIRECTLY AND ACCURATELY

WITH A

HASTINGS AIR-METER

The most sensitive of all air meters for research, industrial and agricultural applications. Reads directly in feet-per-minute on a logarithmic-type scale expanded at lower velocities. Highly sensitive — will indicate the velocity of smoke rising from a cigarette. Response time less than one second. Accurate to within ± 2% regardless of ambient temperature or static pressure.

Uses the exclusive Hastings noble metal thermopile in an extremely stable circuit. Instantaneous range switching without recalibration. Probes available for directional or non-directional reading. Easily adapted for remote recording since the calibration is independent of lead length. Available in several models to meet your specific requirements.

Hastings Model H Air Meter. Compact unit for field and laboratory use. Velocity Ranges: 10-750 fpm; 750-5500 fpm.

Hastings Model G Air-Meter. Small hand type instrument. Velocity range: 0-6000 fpm; Weight: 26 ounces.

Hastings Model B Air Meter for measurements of greatest precision. Velocity ranges: 0-400 fpm; 400 to 6,000 fpm. Meter type continuous calibration check. Knife edge, parallax free indicator.

Write for descriptive literature and prices on Hastings Air Meter, Manometer and Flowmeters, and Vacuum Gauges.

HASTINGS INSTRUMENT COMPANY, INC.

HAMPTON, 33 VIRGINIA

DESIGNERS AND BUILDERS OF RAYDIST AND SPECIAL ELECTRONIC, ELECTRICAL, AND MECHANICAL INSTRUMENTS

with headquarters in Minneapolis. *HAROLD CHAMBERLAIN* has been named modernization market supervisor. The responsibilities of *BERT ENGSTROM* as assistant sales manager of the wholesale division are being expanded to cover the entire country. Previously he was in charge of the territory west of the Mississippi.

JOE E. BRUNDAGE, director of engineering of The Brundage Co., has been elected president of the *FOREMAN'S CLUB* of Kalamazoo. An affiliate of the National Association of Foremen, the group's program is aimed at improving the quality of foremanship of the members.

K. O. SCHLENTNER, assistant manager-research of *THE NATIONAL RADIATOR CO.,* has been named manager-heating research. Another appointment announced by the company is that of *DR. W. M. SHAFER,* as manager-metals research.

Formation of a Sales Engineering Dept., headed by *R. W. WEEKES,* has been announced by the *L. J. MUELLER FURNACE CO.* According to company officials, the new department is intended to "anticipate, meet and remedy all problems arising in its field of operation and to promote sales." Mr. Weekes is in charge of furnaces as well as manager of the department. *L. A. MILES,* refrigeration engineer, is in charge of air conditioning; *D. G. SPAHR,* sales engineer, in charge of boilers, and *G. M. HASE,* sales engineer, is in charge of fittings, registers, grilles and specialties.

DR. CYRIL G. VEINOTT, electric motor design engineer, has joined the *RELIANCE ELECTRIC & ENGINEERING CO.* as consulting engineer on a-c machinery. He had been with Westinghouse Electric Corp. for the past 25 years. Holder of numerous patents and author of *Fractional Horsepower Electric Motors,* Dr. Veinott for many years has also been a special lecturer in electric machine design at the University of Pittsburgh.

MARCUS W. KEYES has been appointed to the new position of sales engineer for the Fiber Glass Div. of the *PITTSBURGH PLATE GLASS CO.* During the past 12 years, Mr. Keyes has been associated with the Kimberly-Clark Corp. as product development engineer.

O. B. WILSON has been named industrial instruments sales manager for the Industrial Div. of *MINNEAPOLIS-HONEYWELL REGULATOR CO.* Mr. Wilson has been with the company since 1923.

Five appointments in various divisions of *KAISER ALUMINUM & CHEMICAL CORP.* have been announced. *RALPH E. KNIGHT,* formerly assistant general manager of the chemical division, has been promoted to a vice presidency in the corporation and will assume the duties of director of research and development for the aluminum and chemical divisions; *W. R. WOODMAN,* formerly manager of chemical operations, has been named manager of the aluminum division's raw material operations;

developed for 10 hp SERVICE

FURNAS

General Purpose enclosure approximately 10¾ x 6¼ x 4¼", smaller than No. 2 and larger than No. 1 conventional sizes. This starter is rated 10 hp., 220-550v AC.

The new Furnas YE series starter has more than ample clearance for wiring, yet it is the smallest starter available for 10 hp. service. *Other reasons for specifying Furnas magnetic controls include:*

- **Silver contacts of high conductivity and superior arc-quenching properties,**
- **Terminal boards of highest arc-resistant material available,**
- **Dual voltage coils regularly equipped on both single and polyphase.**

Full details on the new size 10 hp. starters and contactors sent on request to Furnas Electric Company, 1041 McKee Street, Batavia, Illinois.

SPECIAL CONTROLS *We are prepared to furnish special magnetic starters and contactors as well as drum controllers, pressure switches, foot and cam-operated switches on short notice. Your inquiries are invited.*

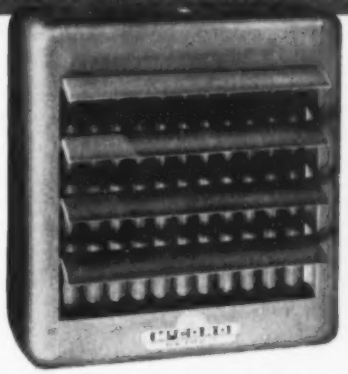
FURNAS

FURNAS *Electric* **MOTOR CONTROLS**

McCORD

HEATING AND AIR CONDITIONING PRODUCTS

HORIZONTAL TYPE UNIT HEATERS



Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.

VERTICAL TYPE UNIT HEATERS

A proven heating unit—all copper coils to resist corrosion. McCord spiral tube fin construction creates air turbulence without undue restriction. Improved fan delivers large volume of air, with minimum air noise. All McCord heaters are guaranteed for use with 150 lbs. saturated steam pressure. Sizes to 575,000 B.T.U. capacity.

McCORD CORPORATION
DETROIT 11, MICH.

FRANK M. CASHIN, who has been general sales manager of the chemical division, becomes manager of that division; *JACK W. WATSON, JR.*, formerly West Coast manager of aluminum sales, has been appointed assistant to the vice president and general manager of the corporation, and *R. A. FRATUS*, assistant to the comptroller, has been appointed to the newly created position of head of the analysis and planning department.

S. H. BEACH, service and installation engineering manager of the *IRON FIREMAN CORP.*, has been promoted to the new post of industrial sales manager for the entire country. Another promotion announced by the company is that of *D. PAUL BAILEY* to the position of assistant sales manager. He has been director of market research since he joined the Iron Fireman organization in 1949.

R. C. SMITH has joined the firm of *KNOWLES ASSOCIATES*, chemical, metallurgical and mechanical engineers in New York, as a partner. Mr. Smith recently resigned as vice president in charge of manufacturing and engineering and development of Eversharp, Inc.

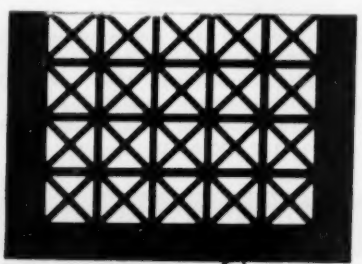
WALTER SCHMIDT has been named director of engineering of the Air Conditioning Div. of *REMINGTON CORP.* He will head the division's engineering and design activities including the new products development program, redesign of present room air conditioner models, production quality control and operation of the experimental laboratory. In addition, as part of the company's program of field service for its Air Conditioning Div., *CARL F. ZAUNER* has been named national service manager, *CHARLES CROSS*, service parts manager and *H. D. KLINE*, field representative.

The following promotions have been announced by the *EUTECTIC WELDING ALLOYS CORP.*: *WALTER R. HILLMAN* has been appointed assistant to the vice president in charge of production; *JOSEPH QUAAS* has been appointed manager of the Electrode Production Div., and *ANDRE JACCARD* has been appointed assistant to the executive vice president.

J. M. CARR, D. G. GREEN, DAVE HOFFMAN and *PHIL MOESZINGER* have been promoted to division managers in the sales department of *RADIATOR SPECIALTY CO.*

Appointment of two men to new posts in the Cleveland Valve Div. of *THE PARKER APPLIANCE CO.* has been announced by *C. J. GIBLIN*, division manager. *WALTER C. LOEMAN*, who has headed cost planning for the comptroller, has been named production manager and *ROBERT C. DYRENFORTH* will take the post of division engineer, with both product and process engineering responsibilities.

After serving 25 years as president, *CHARLES YEOMANS* was recently elected chairman of the board of



for Enhancing beauty —

Specify Hendrick Grilles

Add a touch of beauty and utilitarian design to your decorative motif with Hendrick Perforated Metal Grilles. Your customers will appreciate that extra elegance they add to a room.

Fabricated in sizes with positive, clean-cut perforations and with no burrs or imperfections of any kind, Hendrick Grilles are a cinch to install because they always lie flat — won't bend or warp.

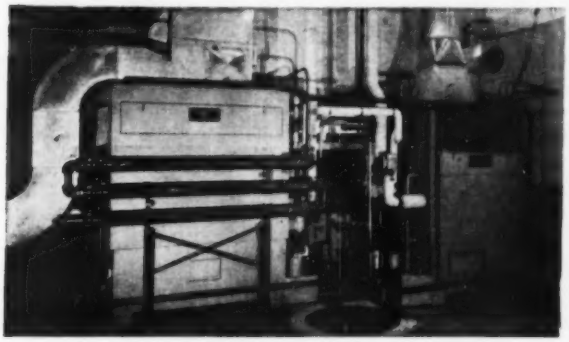
Hendrick Perforated Metal Grilles provide more-than-ample open area for free passage of air flow and they're available in over one hundred attractive designs to choose from in aluminum, bronze, steel or stainless steel. Write for more details, today.

Hendrick
MANUFACTURING COMPANY
48 DUNDAFF STREET, CARBONDALE, PA.
Sales Offices in Principal Cities

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

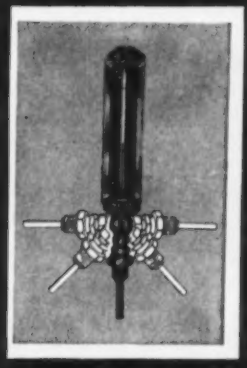
For complete information write

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HP, 405 Lexington Ave. New York 17, N. Y.

Sales Engineers in Principal Cities of U. S. and Canada



Midnight was hours ago . . .

—but on the Research floor of the WEKSLER Thermometer Corp., the lights were still burning. There was little conversation. Technicians paused only for coffee and a quick cigarette . . .

From such long nights of trial and error came the WEKSLER line of Indicating, Recording and Controlling Instruments for Temperature, Pressure and Humidity. Always: tough, accurate, dependable!

Consult the pioneer—consult WEKSLER for your special needs. Write for free literature today

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Catalog #225 Engraved Stem Thermometers & Hydrometers
Catalog #325 for Dial Indicating & Recording Thermometers
Catalog #525 for Dial Indicating & Recording Pressure Gauges
Bulletin #AASD for Adjust-Angle Industrial Thermometers

"Industrial America's Right Arm"

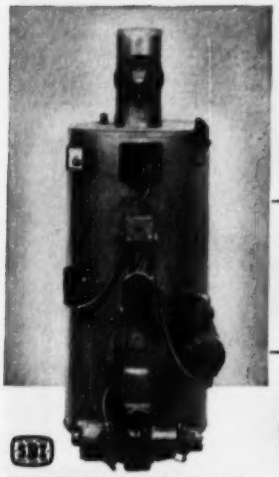
WEKSLER THERMOMETER CORPORATION

Martinique Bldg.

49 West 32nd Street • New York 1, N. Y.

GET ALDRICH *Gulf Stream*

C-SERIES BOILER-BURNERS



P **PERFORMANCE** – With Lasting Economy. Fast, quiet hot water heating . . . instant hot water.

D **DESIGN** – For Today's Market. Quick and easy to install, Aldrich saves money, space, installation time.

Q **QUALITY** – At Quantity Prices. Engineered for instant response to heating needs . . . peak fuel efficiency.

GULF STREAM PACKAGE. Fully erected, pre-wired, accessory-equipped package. Ready to set in place and connect.

EASIER TO SELL...
EASIER TO INSTALL...
EASIER TO SERVICE...

GULF STREAM STANDARD Shipped fully erected with complete automatic controls: stack switch, thermostat and limit control.

HOT WATER HEATER Internally galvanized; 100 to 255 GPH at 100° rise. Instant, directly heated hot water.

ALDRICH *Gulf Stream* OFFERS VALUE . . .

that's profitable to sell, practical to buy.

- **Five sizes with SBI ratings from 440 to 1120 square feet of water radiation.**
- **Multiple flue tubes baffled for maximum heat extraction.**
- **Aldrich burners coordinated to Gulf Stream boilers.**
- **For inspection and maintenance, readily removable top jacket and large opening to combustion chamber.**
- **Minimum temperature change regardless of firing conditions.**
- **Designed for standardized production; to meet ASME code.**
- **Burners U.L. listed.**

THE ALDRICH COMPANY

105 East Williams St., Wyoming, Illinois

A Subsidiary of Breeze Corporations, Inc.

ANOTHER BREEZE MARK PRODUCT

YEOMANS BROTHERS CO. in Chicago. *D. W. BURGOON*, formerly vice president and general manager, was elected president. Other executive changes include the advancement of *L. A. ELLNER* to the position of works manager and *S. A. NORRIS* to sales manager of the pump division, both newly created positions.

Two new appointments in the sales division of *ARMCO STEEL CORP.* are those of *CALVIN D. BECK* as manager of the Dayton district sales office and *ADAM D. SECHRIST* as manager of tubing sales. At the company's Ashland, Ky. Div. *GEORGE YOST, JR.*, has been appointed assistant general superintendent in charge of rolling and processing operations. *WILLIAM VERITY* will succeed Mr. Yost as assistant to the manager of the Kentucky division.

ANDREW F. WARD, previously "Gas-O-Matic" sales manager for the Williams Div. of *EUREKA WILLIAMS CORP.*, has been appointed general sales manager of that division.

RUSSELL J. CROUSE has been appointed general manager of the *NATIONAL HEATER CO., INC.* in St. Paul. The firm also has announced the completion of the first building in its expansion program. The new one-story addition will house facilities for the wiring, assembly and check-out of space heaters.

Tubular Products Div. of *BABCOCK & WILCOX CO.* has announced the appointment of *HAROLD D. NEWELL* as consulting metallurgist and *JOHN J. B. RUTHERFORD* as chief metallurgist. Mr. Newell has been chief metallurgist since 1927 and in his new post will devote his time to specific metallurgical problems. Mr. Rutherford, who has been assistant chief metallurgist, now will be in charge of the research section of the laboratory, process and product development and customer metallurgical service.

JAMES W. MURPHY has been named manager of sales, Stainless and Alloy Castings Div., *ALLEGHENY LUDLUM STEEL CORP.* Other appointments announced by the corporation include *RALPH L. HARDING, JR.*, as market research analyst and *EDMUND C. TYNAN*, who will be with the stainless tubing sales division.

E. A. NASH has been promoted to the post of merchandising manager of the Chrysler Airtemp Div. of the *CHRYSLER CORP.* During the past seven years, he has served as district and regional sales manager and sales training manager of the Chrysler Airtemp Sales Corp. *J. G. KEHOE* will replace Mr. Nash as sales training manager.

JOHN R. CELLA has been appointed manager of the newly created Purchased Industrial Sales section of *CRANE CO.*

LYLE B. SCHUELER has been elected vice president

These EVERLASTING advantages give better service from

BOILER BLOW-OFF VALVES

Fig. 4001/6561. Duplex unit consisting of Straightway Lever-operated Valve and Angle Valve.

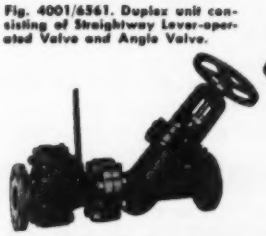


Fig. 4001/6371. Duplex unit consisting of Straightway Lever-operated Valve and "Y" Valve.

Fig. 657 /6561. Duplex unit consisting of "Y" Valve and Angle Valve.

When you install an EVERLASTING Duplex Blow-Off Unit, you'll find that its many superiorities speak for themselves.

The valve at the left is the EVERLASTING design that has been famous for more than 40 years . . . the valve with the drop-tight seal that actually improves with use because of its self-lapping action each time the valve is opened or closed . . . the valve that can't stick or jam because of its non-wedge design . . . the valve that opens in less than a quarter turn to provide unimpeded straight-through blow.

The valve at the right is the equally famous EVERLASTING Angle or "Y" Valve, specially designed and equipped to withstand repeated blow-off shocks, erosion and corrosion, and without pockets that might trap and hold solids.

Each of these valves . . . and all the other EVERLASTING Boiler Blow-Off valve types, fully meet ASME code requirements . . . assurance that they are properly designed and amply strong for the service.

Write for descriptive bulletin.

EVERLASTING VALVE CO., 49 FISK STREET, JERSEY CITY 5, N. J.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF. EV349

FOR EVERLASTING PROTECTION

They SELL! They PLEASE!

AURORA

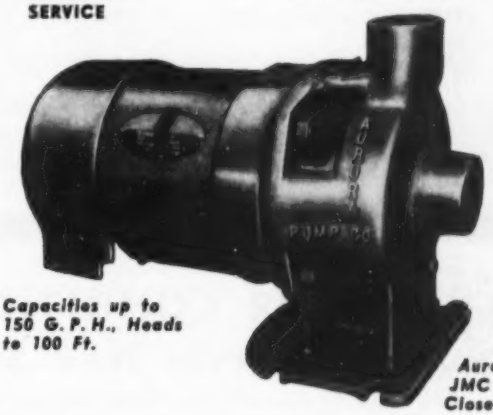
CLOSE-COUPLED *Packaged*

AIR CONDITIONING PUMPS

for EVAPORATOR COOLING TOWERS • AIR CONDITIONING UNITS • *also for* GENERAL SERVICE

These are outstanding pumps, high in favor with air conditioning contractors and manufacturers of air conditioning equipment. Mechanical seal requires no packing or maintenance. Disassembly without disturbing pipe connections or hold down bolts.

- LOW COST
- LONG LIVED
- SMOOTH, QUIET
- MECHANICAL SEAL
- DEPENDABLE
- DISASSEMBLY is QUICK, SIMPLE
- CARRIED IN STOCK



Capacities up to 150 G. P. H., Heads to 100 Ft.

Aurora Type JMC Pump — Close-Coupled

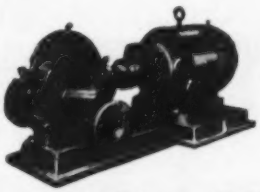
CASINGS vertically split. Casing wearing ring standard.

MECHANICAL SEAL—standard, located in packing cover.

IMPELLER — balanced, enclosed type, high grade bronze.

MOTOR—NEMA specs., stainless steel shaft on JMC — for all circuits and various enclosures.

BALL BEARINGS — on JMC, built into motor.



OTHER AURORA AIR CONDITIONING UNITS

We are also in a position to supply various sizes of air conditioning pumps in V-Belt drive, and flexible coupling drive. Our large size type G.M.C. Close-Coupled Pumps can be furnished up to 800 G. P. M. and heads to 200 ft.

ALSO — AURORA SPLIT CASE CENTRIFUGAL PUMPS

— single and two stage for water supply, handling condenser circulating water, brine circulation, booster service and many other duties.

Complete Information on Request

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

SUBSIDIARY OF THE NEW YORK AIR BRAKE CO.

80 Loucks Street — Aurora, Illinois

in charge of sales of the *DIAMOND POWER SPECIALTY CORP.* Mr. Schueler has been sales manager since spring of 1950. Prior to joining the corporation, he was assistant chief mechanical engineer with the American Gas and Electric Service Corp.

W. C. WALTER is the new general sales manager of Norge Heat Div., *BORG-WARNER CORP.* He formerly was western regional manager. In his new position, Mr. Walter will direct the activities of the national sales program with regional sales representatives and will also have charge of the Canadian Export Div.

DRAVO CORP. has announced the appointment of *D. RUSSELL PEARCE* to the position of assistant purchasing agent of its machinery division. Mr. Pearce joined the firm in 1936 as a sales correspondent and was appointed buyer in the purchasing department in 1939.

ALBERT P. WOODY has been appointed a consultant in steam generation, combustion and boiler process heating for *EGGELHOF ENGINEERS* in Houston. Mr. Woody operated his own company for the past six years.

ROBERT E. CASSATT, advertising manager of *FEDDERS-QUIGAN CORP.*, has been named sales manager of the Refrigeration Appliances Div. Mr. Cassatt, who joined the firm three years ago, formerly was advertising and sales promotion manager of several divisions of General Electric.

J. FRENCH ROBINSON has been appointed to the board of directors of *AFFILIATED GAS EQUIPMENT, INC.* A past president of the American Gas Association, in 1951 he was elected president of Consolidated Natural Gas Co. of New York and chairman of the board of East Ohio Gas Co.

A. KINGSLEY FERGUSON has been appointed vice president in charge of industrial engineering for *WALTER KIDDE CONSTRUCTORS, INC.* Mr. Ferguson joined the firm last year as assistant to the president.

JOHN H. EIKENBERG, vice president in charge of industrial relations, Revere Copper and Brass, Inc., has been named chairman of the *COMMISSION ON LABOR-MANAGEMENT ORGANIZATIONS* of the National Conference of Christians and Jews. Mr. Eikenberg succeeds *DWIGHT R. G. PALMER*, board chairman of General Cable Corp.

ANTHONY MALADRA has recently been appointed assistant sales manager of *KSM PRODUCTS, INC.*

LOUIS A. WALLACE has joined *ANSUL CHEMICAL CO.* as refrigeration product development engineer. In

FRICK
AIR CONDITIONING
Serves New Student Union
Two Frick "ECLIPSE" compressors, seen at the right, provide 120 tons of air conditioning in this building at Kansas State Teachers College, Pittsburg, Kan. Hundreds of students using the rooms are assured the health and comfort of cool, fresh air.
Frick "ECLIPSE" compressors handle low-temperature loads as well as air conditioning. For dependable air conditioning, ice making, quick-freezing or refrigeration service, see your nearest Frick Branch Office or Distributor.
DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.
Also Builders of Power Farming and Sawmill Machinery

Sterlco

EXCLUSIVE DESIGN

KEEPS CORROSIVE CONDENSATE from the MOTOR SHAFT

Notice this unique feature on the Sterlco 4100 and 4200 Series Condensation Pumps. The bronze impeller hub completely covers and protects the motor shaft and the carbon type rotary seal runs on the impeller hub and not the motor shaft. This feature protects the motor shaft from corrosion by the condensate.

Sterlco CONDENSATION PUMPS

4200 Series with cast iron tank illustrated. 4100 Series for jobs where steel tank is preferred.

Only two sizes required to take care of all jobs up to 15,000 sq. ft. E.D.R. — and up to 20 lbs. discharge pressure. The easily adjustable float switch, plus other Sterlco features, make this possible . . . and possible only with a Sterlco Pump. For you this means less working capital tied up in floor stock. For your customers this means a future increase in radiation may not require a new pump.

These exclusive design features, combined with overall RUGGED CONSTRUCTION and LOW COST, make Sterlco PUMPS first choice of the industry. Send for complete information.

STERLING, INC.

3732 N. Holton St., Milwaukee 12, Wisconsin

CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

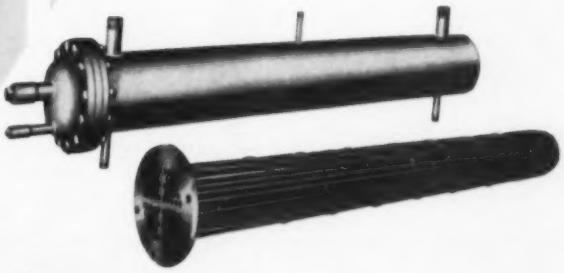
TEMPERATURE CONTROLS

BETTER COOLING WITH

Taco

"CONTROLLED VELOCITY" CHILLERS

1. Improved heat transfer
2. Rapid response to Thermal Expansion Valve
3. No oil logging and slop over



Because . . .

TACO'S "CONTROLLED VELOCITY" TUBE BUNDLES

Carry *all* incoming liquid to the top of the Chiller in the first pass.

Provide constant forward movement of *all* refrigerant and oil.

Prevent accumulation of liquid (refrigerant or oil) in any part of the Chiller.

And because . . .

TACO'S "CONTROLLED VELOCITY" HEADS . . .

Agitate oil and liquid refrigerant, at each head pass, with a constant stream of expanding gas.

Provide unretarded flow of refrigerant.

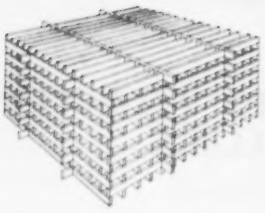
Eliminate "traps" for oil and liquid refrigerant

For full information and Taco's "pin-point" Selection Charts, write for Bulletin CWF.

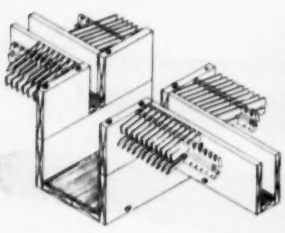
TACO HEATERS INCORPORATED
137 South Street Providence 3, R. I.

4 outstanding features in cooling towers

that insure high performance, less maintenance, and long life.

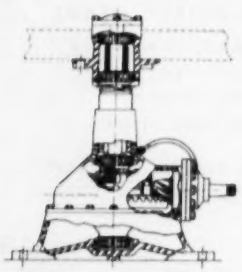


WCEC Improved Nail-less Grid Type Fill provides maximum wetted surface and maximum retardation of water to completely utilize the heat removing capacity of the air, resulting in highest cooling efficiency.



WCEC Patented Drift Eliminators efficiently remove the entrained moisture carried by the air as it leaves the tower, resulting in less water being lost.

WCEC Patented Cast Iron Timber Connectors develop the greatest structural strength of the timber joints, an accomplishment almost impossible to achieve by bolting alone.



WCEC Reduction Gears are the best type for cooling towers because their semi-floating axle prevents any weight or thrust of the fan being transmitted to the gears.

Manufacturers of various types and sizes of mechanical draft and atmospheric cooling towers.

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Water Cooling EQUIPMENT COMPANY

TOWERS OF STRENGTH WCEC

MAIN OFFICE • 8601 New Hampshire Ave. • St. Louis 23, Mo.

Fabricating Plants: St. Louis, Mo. • Arcata, Calif. • Houston, Texas

REPRESENTATIVES IN TWENTY-EIGHT PRINCIPAL CITIES

his new position, Mr. Wallace will evaluate and test new mechanical products and will supervise the company's cold room and refrigeration laboratory. Previously he had been manager of the Evansville, Ind. branch of F. H. Langsenkamp Co.

IN THE TERRITORIES . . .

For *BAILEY METER CO. — G. M. WALLACE* is the new assistant sales manager with headquarters in Cleveland. He has been manager of the Denver district since 1945.

For *RADIATOR SPECIALTY CO.* — Two new representatives for "Solder Seal" products. *THEODORE A. MARCY* now is in charge of the Indianapolis area and *JOSEPH F. REGAN* is head of the St. Paul area.

For *THE FOXBORO CO. — DALE G. HUGLEY* is resident engineer at the company's new branch office in Wichita, established to serve the Kansas area. The new office is located at 2207 S. Pinecrest. Mr. Hugley goes to the Wichita branch after serving as industrial engineer at the Tulsa office.

For *GUSTIN-BACON MFG. CO. — BARTH GILCRIST* is division manager at Philadelphia. Since joining the company in 1948, he has been a sales and service engineer in the eastern division. *LEONARD E. FEITT*, presently resident salesman in Pittsburgh, will be Mr. Gilcrist's assistant.

For *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Valve Div. — Three salesmen named to new field posts. *FRANK DAY* will handle industrial valve sales in the New Orleans area, *VINCENT LO SCALZO* in Kansas City, Mo. and *V. L. EVANS* in Wilmington, Del.

For *SERVEL, INC. — SNOOK & ADERTON, INC.* of Lubbock, Texas has been appointed Servel air conditioning distributor for the south plains area of west Texas. Officers of the firm are *MARCUS J. ADERTON*, president, and *EDWIN SNOOK*, vice president and general manager.

For *SPANG-CHALFANT DIV. of NATIONAL SUPPLY CO. — RICHARD S. SKINNER* has been transferred from the St. Louis office to Denver as tubular salesman. Denver now is the headquarters for the company's oil field division serving the Northwest.

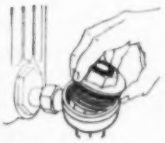
For *DE LAVAL STEAM TURBINE CO. — LEONARD P. MELLGREN* has been appointed district sales engineer and will head the company's new district offices in Minneapolis. The new district consists of Minnesota, North Dakota, South Dakota and adjoining sections of Wisconsin.

For *THE WATTS REGULATOR CO. — PETER L. BRANDES* is the new direct factory representative. Mr. Brandes will cover upstate New York from Albany, west

—in 2 minutes

old steam traps made new!

Close the radiator supply valve and remove the trap cover with a monkey wrench.



Remove old element (usually screwed into the cover). Clean surface around the seat. Remove the old seat if necessary according to instructions accompanying all shipments.

Place the new B & J cage replacement unit in position. Clean seating surfaces of cover and body and replace cover.

7-G

Three simple motions will make a brand new steam trap without disturbing the pipe connections. The B & J cage unit can be supplied to fit any make of trap—any pressure up to 100 pounds. It eliminates guess work.

It is complete in one piece and even replaces the old valve seat. It has given outstanding service for years in B & J radiator traps. No field adjustment necessary.

Other exclusive B & J specialties include a new Proportionator Control System for vapor heating, an adjustable orifice valve for steam systems, and many styles and sizes of steam traps, all distinguished by the B & J patented thermostatic unit. Bulletins on request.

Send for this booklet and, if you wish, a free sample of a cage unit that will fit your traps — state make, pipe size, model no. and pressure.

for Quality

B&J Barnes & Jones INCORPORATED

REPRESENTATIVES IN PRINCIPAL CITIES

BOSTON 30, MASSACHUSETTS

Why Make a MUDDY MESS every time you insulate a pipe fitting?

Here's the MODERN WAY!

NICOLET *Pre-Formed* FITTING INSULATION

Easy does it! The insulation comes in molded shapes and sizes to fit all ells, tees and 45's in cast iron screwed fittings, ½" to 8" inclusive, also welded fittings, 2" to 8". The installation is dry, neat, quick and uniform. The two segments are held in place with staples (which we furnish), tape or canvas—that's all for a clean, streamlined insulation that fits perfectly. And note, as shown by the photo, the fitting insulation is installed first—then the straight covering is brought up to it and the canvas is applied. No time is lost, waiting for drying, and no shrinking as with mud insulation. No need to return to point up cracks.

Greater efficiency is secured, because Nicolet Insulation is made principally of glass fibres, lower in thermal conductivity than any other fitting insulation.

Nicolet Pre-formed Fitting Insulation will not flake or chip or crack. It is immune to moisture, rot, corrosion, odors and insects. Tests indicate a life for the fibers equivalent to more than 150 years of normal service.

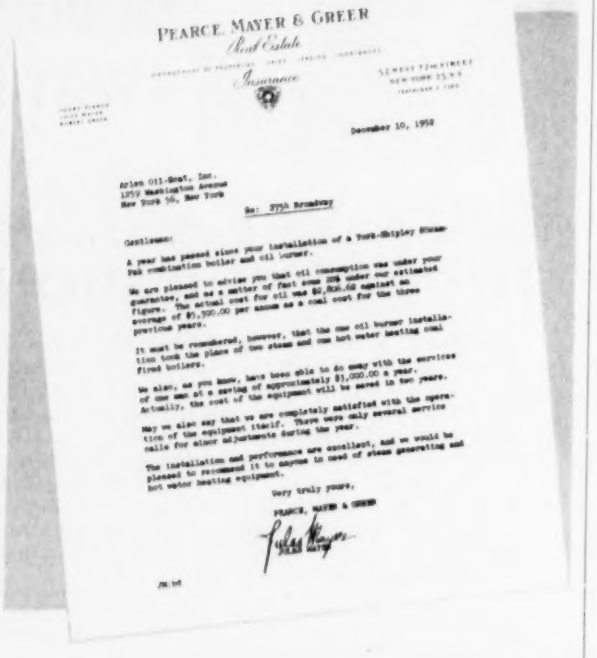
SEND FOR FREE SAMPLE. **Ask your wholesaler for a free sample of the Nicolet Pre-Formed Fitting Insulation, with descriptive pamphlet and price list. Also, for a catalog of the complete line of Sal-Mo asbestos, sponge and wool felt pipe coverings, sheets, blocks and asbestos cements. Or write:**

SALL MOUNTAIN COMPANY

Makers of Fireproofing & Insulating Materials

HAMILTON, OHIO

Heating Costs for Six Buildings Cut $5,493.38 By Steam-Pak Generator



PEARCE, MAYER & GREER
Real Estate
Insurance

December 10, 1952

Arlen Oil-Heat, Inc.
1259 Washington Avenue
New York 56, New York

Re: 375th Broadway

Gentlemen:

A year has passed since your installation of a York-Shipley Steam-Pak combination boiler and oil burner.

We are pleased to advise you that oil consumption was under your guarantee, and as a matter of fact some 20% under our estimated figure. The actual cost for oil was $2,826.62 against an average of $5,320.00 per annum as a coal cost for the three previous years.

It must be remembered, however, that the new oil burner installation took the place of two steam and one hot water heating coal fired boilers.

We also, as you know, have been able to do away with the services of one man at a saving of approximately $3,000.00 a year. Actually, the cost of the equipment will be saved in two years.

May we also say that we are completely satisfied with the operation of the equipment itself. There were only several service calls for minor adjustments during the year.

The installation and performance are excellent, and we would be pleased to recommend it to anyone in need of steam generating and hot water heating equipment.

Very truly yours,

PEARCE, MAYER & GREER

Real Estate

jm:ed

• This is but one of the cost-saving reports on Steam-Pak Generators, which are built for high or low pressure work in a complete range of sizes from 15 to 300 hp. with oil, gas, or combination firing.

YORK-SHIPLEY, INC. - Industrial Division, York 5, Pa.

GET MORE STEAM-PAK FACTS TODAY

Please send me additional data on York-Shipley Steam-Pak Generators.

Name.....

Company.....

Address.....

City.....State.....

STEEL TO STEEL KEEPS FINS TIGHT

Maximum efficiency in finned radiation requires perfect, continuous contact between fins and pipe at all times for only when this contact is perfect will there be maximum heat transfer from pipe to fins and from fins to room air.

AUTORAD uses steel for *both* tube and fins and since the coefficient of expansion of fins and tubing is the same, no amount of expansion or contraction can lessen the bond between them and decrease heat transfer. And no electrolytic action can destroy the perfect bond.

AUTORAD has developed a method of bonding fins to tubing so that the resulting contact is as firm and perfect as a welded joint. As a consequence heat transfer is kept at peak efficiency.

To you as a contractor this means long years of customer satisfaction and customer satisfaction means greater profits to you.

Ask for complete data and prices.

AUTO-RAD *Inc.*

3535 Fillmore Street, Chicago 24, Illinois

to the Pennsylvania state line and north to the Canadian border.

For *THE NATIONAL RADIATOR CO. — ROBERT J. SKARDA* now is covering the New Jersey sales territory for the New York branch.

For *PYLE-NATIONAL CO.*, Air Panels Div. — *THE TECHNICAL PRODUCTS SERVICE AND SALES CO.* of Louisville is the new sales representative in that area. The territory consists of the northern half of Kentucky and part of the southern half of Indiana.

For *GUSTIN-BACON MFG. CO. — THE BENJAMIN FOSTER CO.* of Philadelphia is a new distributor in that area. *ACHENBACH & BUTLER CO.*, who also has been handling Gustin-Bacon products in that area, will continue to do the contract work.

The company also has announced the appointment of *GEORGE R. McMULLEN* as manager of its Kansas City sales division. *W. M. DOUGHMAN* and *GRANT I. WYRICK* of Kansas City have been assigned to the division as sales and service engineers.

For *REYNOLDS METALS CO. — ALUMINUM DISTRIBUTORS* of Chicago has been appointed distributor of Reynolds Aluminum Mill products.

For *U. S. STEEL, NATIONAL TUBE DIV. — MORRIS, WHEELER & CO.* of Philadelphia has been appointed distributor for seamless pressure tubing in iron pipe sizes manufactured by U. S. Steel.

Two authorized service stations to handle servicing for the entire line of "Quiet Kool" room air conditioners have been announced by the Quiet Kool Div. of *QUIET HEET MFG. CO.* The *TIPTON HEAT PUMP AND VALVE CORP.* of Miami, Fla. will handle servicing for the state of Florida. The *CENTER AIR CONDITIONING AND HEATING CO.* of Dallas has been named to handle all servicing within a 500-mile radius of Dallas.

For *CHRYSLER AIRTEMP SALES CORP. — WEISS AND BESSERMAN, INC.*, New York appliance wholesalers, have been appointed distributors for Chrysler Airtemp room air conditioners and dehumidifiers. The firm will service retail outlets in metropolitan New York, New Jersey and lower Connecticut.

For *ECLIPSE FUEL ENGINEERING CO. — GENERAL COMBUSTION CO.* is the new district representative covering the states of Alabama and northwestern Florida. *FRANK MATZEK* and *CHARLES HERRON* will handle sales and service from their office in Birmingham.

For *BINKS MFG. CO. — STUART G. PIZIE ASSOCIATES* in Miami will represent the firm's line of cooling towers and heat exchange equipment in southern Florida.

Airplane View of Villanova College. The College Buildings are Heated by the Central Heating Plant Shown at the Extreme Left. The Therm-O-Tile lines Radiate from the Central Plant.

VILLANOVA COLLEGE

is heated through

THERM-O-TILE

Reg. U. S. Pat. Off.

UNDERGROUND STEAM CONDUIT

Therm-O-Tile is ideal for the heating of colleges and universities because it is PERMANENT and MOST EFFICIENT. It is permanent because the solid concrete base and the tile covering cannot decay. It is efficient because the steam piping is surrounded by sealed air as well as permanently dry insulation.

Therm-O-Tile Assembly View. Note the Channel Drain in the Concrete Base. Ask for Bulletin 511 which gives Complete Information Concerning Therm-O-Tile.

Specify Therm-O-Tile

Whatever your steam conveying problem is — under ground — get in touch with the Porter-Hayden office nearest you, or, a Johns-Manville Technical Service Unit.

H. W. PORTER & CO., INC.

822-H Frelinghuysen Avenue • Newark 5, N. J.

REID HAYDEN, INC.

BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.

Insulation Engineers & Contractors

MEETINGS & CONVENTIONS

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2. — Conference and exhibition, March 16 to 20, Sherman Hotel, Chicago. Titles of six papers to be given are: "Use of All-Plastic Equipment and Piping in Technical Corrosion Protection;" "Corrosion by Acids at High Temperatures;" "Metallurgy of Corrosion;" "Statistical Analysis of Corrosion Data;" "Corrosion Study in a Salt Plant;" "The Behavior of Titanium in Sulfuric and Hydrochloric Acids."

PROTECTIVE COATINGS SYMPOSIUM, to be held during National Association of Corrosion Engineers Chicago conference, March 20 — One of the five papers to be presented at this session is, "Field Tests of Exterior Coatings for a Pipeline Conveying Fuel Oil Heated to 200 Degrees F," by E. R. Stauffacher and B. R. Davidson, which relates field tests and experience in selection of protective coatings for 41 miles of 8-in. schedule 30 pipe.

EIGHTH OREGON STATE AIR CONDITIONING CONFERENCE — March 18-20, sponsored by the Oregon Chapter, ASHVE. The meeting is to be held in conjunction with the 1953 Northwest Heating and Air Conditioning Exposition at the Lincoln High School, Sixteenth and S.W. Salmon Streets, Portland. Chairman is Ed Lokey, 10304 N.E. Sandy, Portland 20. For further information see page 157.

NATIONAL COLLEGIATE-INDUSTRY-GOVERNMENT CONFERENCE ON INSTRUMENTATION— March 19-20, Michigan State College, East Lansing. The meeting is sponsored by the college's Electrical Engineering Dept. in cooperation with the National Science Foundation, the National Bureau of Standards, the Instrument Society of America, and the American Society for Engineering Education. Additional information is available from Prof. R. J. Jeffries, Dept. of Electrical Engineering, Michigan State College.

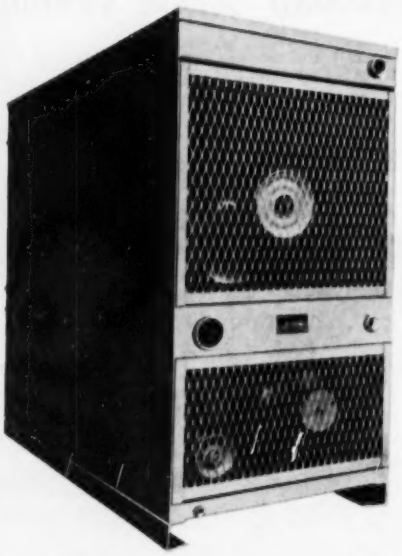
CONFERENCE ON FLUID MECHANICS — Third midwestern conference, March 23-25, University of Minnesota, Minneapolis. The subject matter will cover all features of theoretical and applied fluid mechanics.

AMERICAN POWER CONFERENCE—Second annual meeting, March 25-27, Sherman Hotel, Chicago. The conference is sponsored by the Illinois Institute of Technology in cooperation with nine universities and ten local and national engineering societies. Some of the sessions to be presented include: Problems of Fuel Conversion, Heat Pump Research and Applications, Heating of Modern Homes, Residential Air Conditioning, and Residential and Commercial Heat Pumps. Further information may be obtained from E. R. Whitehead, Secretary, American Power Conference, Illinois Institute of Technology, Chicago 16.

NEW UNITED LO-TEMP SERIES

Redwood Filled Steel Towers

3 to 15 Tons Capacity



★

Compact . . Durable . . Easily Installed . . Indoors or Out.

Made of 14-Gauge Copper Bearing Steel.

Coated Inside with Rubberized Asphalt.

Available on Short Notice with or Without Water Pump.

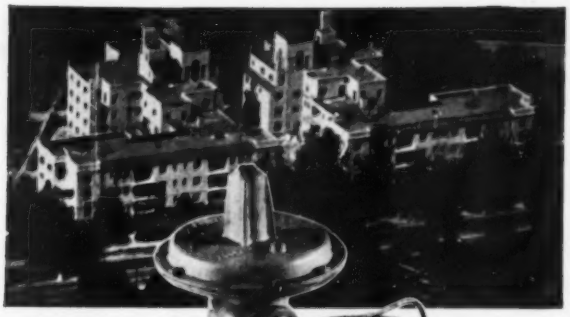
Also Package Type Redwood Spray Towers . . 3 to 30 Tons

Write for Full Details and Low Prices

UNITED COOLING TOWER COMPANY

4022 Broadway, Kansas City 2, Mo. **Plant: Pilot Point, Texas**

Authorized Representatives in Principal Cities



Lo-BLAST Burners heat this huge Cincinnati apartment building.

FOR EVERY TYPE OF BUILDING

LO-BLAST

IS THE LOW-COST WAY TO HEAT WITH GAS

Every dollar trimmed from operating expense shows up on the profit side of the ledger. That's why fuel-saving Lo-BLAST Power Gas Conversion Burners are the sensible selection for buildings which must produce income . . . or for home owners concerned with keeping living costs down.

Lo-BLAST operating cost averages 10% less

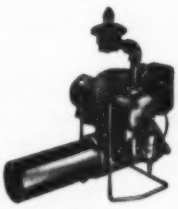
The Lo-BLAST principle of combustion utilizes an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air. Hence operation is always independent of natural draft conditions—makes the Lo-BLAST ideal for down-draft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to the crown sheet as well as side walls. There's no combustion roar—the flame is soft and *quiet!*

High efficiency on intermittent operation

Lo-BLAST Burners show only a small drop in over-all efficiency when changing from constant to intermittent operation. This is the reason for Lo-BLAST fuel economy, since intermittent operation is the normal condition for any heating plant.

Factory-tested on gas, shipped completely assembled

Installation and servicing are easy *because there's nothing in the firebox but the fire!* All units have standard controls with positive acting pilot and blower safetys.



Lo-BLAST Economite
Residential size — 70,000 to 500,000 BTU—with all the fuel-saving features of the standard Lo-BLAST.

Capacities from 70,000 to 20,000,000 BTU input. Write for engineering data.

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

Simple, practical ventilation for many kinds of buildings

The *original* continuous ventilator

The Heat Valve as developed and improved by Swartwout has proved to be one of the most adaptable ventilator designs. Originally applied principally to ridge peaks, its use on slopes or flat roof surfaces has become common. Popular uses in the smaller sizes include saw-tooth construction and skylights.

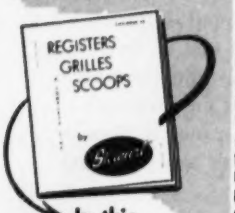
Heat Valve is designed for maximum capacity with lowest friction, and greatest assistance from outside air currents. It provides practically any area of roof opening desired, at economical cost. Can be quickly and easily installed. Always weatherproof, with fully adjustable damper for exhaust control when needed. Various damper operating methods are available.

Swartwout-Dexter Heat Valve is made in 10 throat sizes, in standard 10 ft. lengths. Can be made of special materials when acid or fume conditions prevail . . . Get the full story — write for Bulletin HV-F.

Low overall height of Heat Valve enhances appearance — is an advantage structurally.

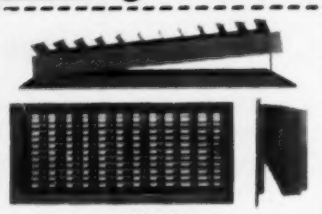
18511 Euclid Avenue, Cleveland 12, Ohio
The Swartwout Co.
Roof Ventilators and Ventilating Louvers
POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

when in the dark...
Look to
Stewart
for Outstanding
New Advances in
Air Conditioning Outlets

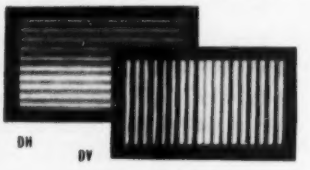


In this Complete Catalog...

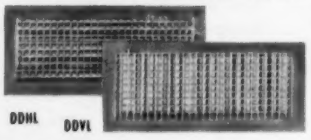
For Quality, Originality, Economy and Fast Delivery—your best choice is Stewart for Industrial and Commercial Registers — Grilles and Air Controls. You'll find one to suit your every need in the new 28 page Catalog #53.



SCOOPMASTER
Eliminates sheet metal collar—directs and controls air

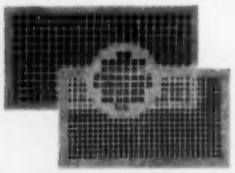


SINGLE BANK OUTLET



Triple Bank Registers Individually Adjustable Fins

Opposed-Action Valves
optional with all Supply and Return Air Registers.



PLAIN LATTICE GRILLES

SCOOPTROL
Deflects and controls the air from a supply duct into a collar

Stewart MANUFACTURING CO., INC.
Grove Ave., Essex County, Cedar Grove, N. J.
2241

Representatives in the Principal Cities of United States, Canada and the West Indies.

AMERICAN GAS ASSOCIATION RESEARCH AND UTILIZATION CONFERENCE, 420 Lexington Ave., New York 17—April 7-9, Hotel Statler, Cleveland. Some of the subjects to be covered are: galvanized water heater tank corrosion, principles of venting, gas vs. electric water heaters, burner research and other domestic utilization topics.

NEW JERSEY SOCIETY OF PROFESSIONAL ENGINEERS, INC., 86 E. State St., Trenton — 29th annual convention and exhibition, April 17-18, Hotel Essex House, Newark.

OIL-HEAT INSTITUTE OF AMERICA, INC., 6 East 39th St., New York 16 — 31st annual convention, April 20-21, Edgewater Beach Hotel, Chicago.

AMERICAN ASSOCIATION OF SPECTROGRAPHERS — Symposium on "Emission Spectroscopic Determination of Metals in Non-Metallic Samples," May 1, Chicago. Chairman is J. P. Pagliassotti, Standard Oil Co., Box 431, Whiting, Ind.

ELEVENTH ANNUAL ANTHRACITE CONFERENCE —May 7-8, Lehigh University, Bethlehem, Pa., sponsored by the university and the Anthracite Institute. Latest developments in the distribution, utilization, economic and hygienic aspects of anthracite will be discussed.

HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION — 64th annual convention, May 13-16, Edgewater Beach Hotel, Chicago. Secretary, Joseph C. Fitts, 1250 Avenue of the Americas, New York 20.

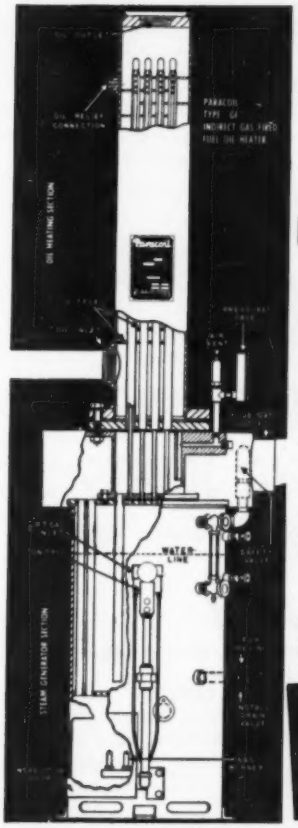
AIR POLLUTION CONTROL ASSOCIATION, 4400 Fifth Ave., Mellon Institute Building, Pittsburgh — Annual meeting, May 25 to 28, Lord Baltimore, Baltimore.

NATIONAL DISTRICT HEATING ASSOCIATION, 827 N. Euclid Ave., Pittsburgh 6. — 44th annual meeting, June 9 to 12, Lookout Mountain Hotel, Chattanooga, Tenn.

FOURTH ANNUAL STORE MODERNIZATION, BUILDING AND MAINTENANCE SHOW, Madison Square Garden, New York, June 9-12 — Sponsored by the Store Modernization Institute, 20 E. 55th St., New York 22, it will cover physical properties and operation of retail stores including warehousing and distribution.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18. — National Spring Technical Meeting, June 16 to 19, 1953, Shamrock Hotel, Houston. Includes a four-day Welding and Allied Industry Exposition in the Shamrock Hall of Exhibits.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION—61st annual meeting, June 22-26, University of



WHY BURN EXPENSIVE LIGHT FUEL OILS . . . . . THERE'S A WAY OUT WITH OUR

Paracoil TYPE "GF"

INDIRECT GAS FIRED FUEL OIL HEATER

A RADICALLY NEW APPROACH TO THE PROBLEM OF ADEQUATE OIL PREHEATING UNDER ALL OPERATING CONDITIONS!

The Type "GF" Oil Heater is an integrated self-contained steam vapor generating exchanger using gas as its primary heat source.

However, the gas flame does not come in contact with the tubes containing the fuel oil. Instead, vapor from the lower steam generating section does the actual oil heating!

APPLICABLE TO ALL TYPES OF OIL FIRED APPARATUS!

As it is not dependent upon the unit it is servicing for the means of heating the oil, the Type "GF" Heater can be applied to any oil fired apparatus, be it a steam or hot water boiler, a process oven, a dryer or a kiln!

A COMPLETE SOLUTION TO THE OIL-IN-BOILER PROBLEM!

As the Type "GF" Heater is in no way connected to the steam or water space of any boiler it may be serving, there can be no possible contamination of the boiler heating surfaces in the event of an oil leak in the heater.

CHECK THESE FEATURES!

Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel • High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated • Reduces oil consumption through improved fuel combustion.

THE PERFECT HEATER FOR:

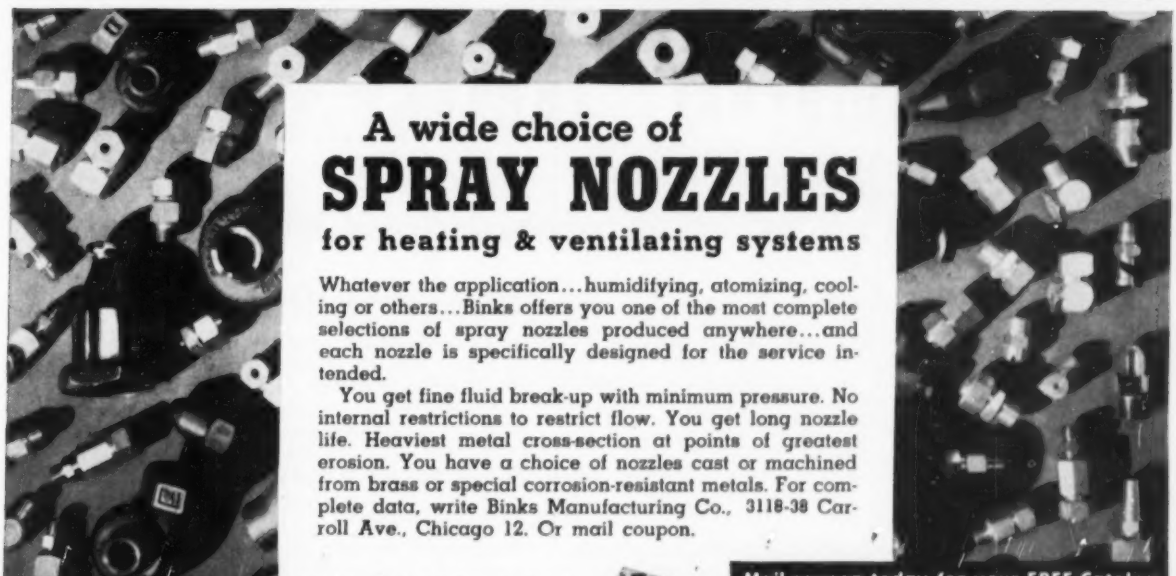
- Low temperature forced hot water heating systems on No. 6 oil.
- Plants with starting difficulties after week end shutdowns.
- Supplementing inadequacies in present oil preheating systems.

Approved by Board of Standards and Appeals, City of New York—Cal. No. 362-51SA

BULLETIN 60-L WRITE FOR YOUR COPY TODAY!

DAVIS ENGINEERING CORPORATION

30 ROCKEFELLER PLAZA, NEW YORK 20, NEW YORK • 1064 EAST GRAND STREET, ELIZABETH 4, NEW JERSEY



A wide choice of SPRAY NOZZLES for heating & ventilating systems

Whatever the application...humidifying, atomizing, cooling or others...Binks offers you one of the most complete selections of spray nozzles produced anywhere...and each nozzle is specifically designed for the service intended.

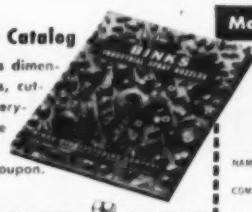
You get fine fluid break-up with minimum pressure. No internal restrictions to restrict flow. You get long nozzle life. Heaviest metal cross-section at points of greatest erosion. You have a choice of nozzles cast or machined from brass or special corrosion-resistant metals. For complete data, write Binks Manufacturing Co., 3118-38 Carroll Ave., Chicago 12. Or mail coupon.

Binks

EVERYTHING FOR WATER COOLING

Send for helpful Nozzle Catalog

40-page Catalog 5200 contains dimensions, spray angles, capacities, cutaway drawings...in fact, everything you need for nozzle specification or selection. And it's FREE...just mail coupon.



A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

REPRESENTATIVES IN ALL PRINCIPAL CITIES • SEE YOUR CLASSIFIED PHONE DIRECTORY

Mail coupon today for your FREE Catalog

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

Gentlemen: Please rush me a FREE copy of your Spray Nozzle Catalog 5200.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

THE *APPROVED* AND *SPECIFIED* BACKING RINGS FOR WELDING PIPE, VALVE AND FITTING JOINTS

A 100% Efficient Welded Joint. Produces a Perfect X-Ray, Radiograph or Gamma Ray Picture for High Temperature Services

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GENERAL OFFICES — 675 GARDEN ST., ELIZABETH, N. J. Phone EL. 2-9613-4. IVAN S. FORDE, JR., *Sales Manager*

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Manufacturers' Agents

Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their heating, piping and air conditioning.

If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

Heating Piping & Air Conditioning

6 N. Michigan Ave. **Chicago 2, Ill.**

Florida, Gainesville. Plans call for more than 100 conferences including a series on atomic energy engineering; lectures on digital computers and discussions by industrial economists. General chairman is Prof. John C. Reed, head of mechanical engineering at the University of Florida. The meeting will be preceded by a three-day summer school, beginning June 20, sponsored by the society's industrial engineering division.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—Spring meeting, June 27-July 1, Lake Placid Club, Lake Placid, N.Y. The 1953 winter meeting will be held in Washington, D.C. and the spring 1954 meeting in Philadelphia. This meeting will mark the 25th anniversary of the Philadelphia section and the 50th anniversary of *ASRE*.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — Semi-annual meeting, June 29, 30, July 1, Denver, Colo. For further information see page 133.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia 3—1953 annual meeting, June 29-July 3, Chalfonte-Haddon Hall, Atlantic City.

INSTRUMENT SOCIETY OF AMERICA, 921 Ridge Ave., Pittsburgh 12 — Eighth National Instrument Exhibit, September 21-25, Sherman Hotel, Chicago.

INTERNATIONAL CHURCHMANS EXPOSITION, 19 S. LaSalle St., Chicago 3 — Second annual exposition, October 6-9, Chicago Coliseum. Hall of Church Designs and International Church Buildings Forum will be featured.

SOUTH CENTRAL REGION, NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2 — October 7-9, Mayo Hotel, Tulsa. This region consists of the states of Colorado, Kansas, Oklahoma, Arkansas, Louisiana, Texas and New Mexico.

NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS—Ninth annual meeting, October 8-9, Sheraton Hotel, Chicago. Sponsored by the Illinois Institute of Technology, Chicago 16, the conference director is Otmar E. Teichmann.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17—35th annual convention, October 26-28, Kiel Auditorium, St. Louis. Hotel Reservations are available from the Hotels Convention Bureau, American Gas Assoc., Rm. 405, 911 Locust St., St. Louis 1.

EIGHTH ALL-INDUSTRY REFRIGERATION AND AIR CONDITIONING EXPOSITION, 1346 Connecticut Ave., N.W., Washington 6, D.C. — November 9-12. Cleveland Public Auditorium, Cleveland.

Kathabar

MAINTAINS IDEAL PRODUCTION WEATHER IN YOUR PLANT—EVERY DAY —YEAR ROUND.

Humidity conditioning saves Haloid Co. $40,000.00 yearly!

The Haloid Company, prominent Rochester, N. Y. photographic paper manufacturer, installed Kathabar humidity conditioning equipment to supply dry air for *continuous* drying of photographic paper. Kathabar replaced conventional air conditioning equipment and *saves Haloid $40,000 annually.*

In addition to improving Haloid's product quality, Kathabar paid for itself in the first year.

LET US SEND YOU the Kathabar Engineering File Folder. This and other information describes what Kathabar has accomplished to date. It may give you some idea on how you can profit from its use.

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☐ Send me the Kathabar Engineering File Folder.

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SURFACE COMBUSTION Corporation
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Kathabar HUMIDITY CONDITIONING SYSTEMS

'Surface' INDUSTRIAL FURNACES AND BURNERS

Janitrol AUTOMATIC HEATING EQUIPMENT

BROWN
BAYCE-HEET
THE NEW LEADER
IN
INDUSTRIAL FINTUBE
EXCLUSIVE
All other manufacturers expand the tube to bond the fins. This practice tends to weaken the tube and often results in tube fracture at the weld. Brown Heavy-Duty Bayce-Heet is made by a new improved process. The fins are beaded onto the tube. No expansion of the tube is necessary. Thus the tube is strengthened and will not fracture.
This exclusive Brown process does more! It provides a perfect bond for most efficient heat transfer. It makes it possible to cut and rethread the tube at any point . . . a welcome advantage when an odd length is needed on the job. No other fintube gives you this advantage.
EASIER TO INSTALL
GREATER EFFICIENCY
32 FINS PER FOOT
10-15% LOWER COST
SAFETY FIRST! Heavier gauge fins with rounded corners guard against cut fingers when installing.
BROWN PRODUCTS COMPANY
FOREST HILLS, NEW YORK
ILLUSTRATED LITERATURE ON REQUEST

NEW BOOKS & REPORTS

Handbook on Heating

For the first time in almost 20 years, the C. A. Dunham Co. has published a *Handbook on Heating*. The new volume contains a wealth of information on how to select and apply a variety of heating equipment. The book covers: wet heating systems; convector, baseboard, and fin-vector radiation; propeller fan, cabinet and blower types of unit heaters; pumps; specialties; control equipment; engineered radiation; special purpose pumps and related products, and engineering data on steam, water, piping, pipe and fitting dimensions, weights and measures.

Within each category, sections are devoted to description, selection and application. Detailed line drawings show the operation of the various units, typical heating and piping layouts and installation procedures. Numerous capacity tables are included. The last section gives complete definitions of the terminology used.

Members of the Dunham staff who had responsibility for producing the Handbook are: Lewis Smith, special sales representative; E. W. Cardiff, former advertising manager; W. D. Berry, application engineer, and D. N. Crosthwait, technical advisor.

The volume is dedicated to O. J. Prentice, who died in July 1952. Mr. Prentice, a member of the firm for 30 years, was instrumental in producing the first Handbook published in 1922.

Priced at $5.00 a copy, the 397-page book may be obtained from the C. A. Dunham Co., 400 W. Madison St., Chicago 6.

Proposed Revision of ASRE Standard

The *Proposed Revision of ASRE Standard, 16-53, Methods of Rating and Testing Air Conditioners,* supersedes ASRE Standards 13, 16 and 16-R. Published by the American Society of Refrigerating Engineers, the new booklet is the work of the 1952 Task Revision Committee. It includes the cooling, heating and other functions of self-contained air conditioners, room air conditioners, remote-type air conditioners, heat pumps, and oil and gas-fired air conditioners.

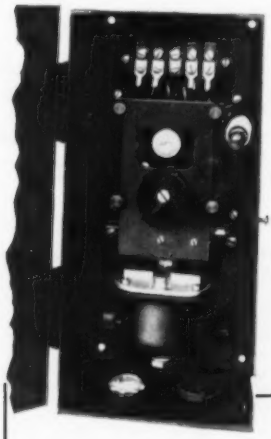
This latest revision affects primarily the room air conditioner portion of the Standard and is for the purpose of providing alternate testing methods in addition to the calibrated room specified in 16-R, which was a revision of Standards 13 and 16.

In general, the test apparatus described in this latest revision is of the same type as described in the original Standards except for the inclusion of the Calibrated Room Calorimeter, which is primarily intended for testing room air conditioners of the free-delivery type. Since this apparatus does not require attachments to air inlets or outlets, it avoids the possibility of influencing the ratings as might be the case where such attachments are applied to certain types of room air conditioners.

The proposed revision includes sections on classification, basis of rating, instruments, calorimeters and auxiliary equipment, air flow measurement, liquid flow measurement, cooling capacity tests, heating capacity tests, a humidifying capacity test and definitions and symbols.

Want more uniform heat?

THE Taylor Electro Pneumatic Interrupter acts as a valve to proportion the flow of electrical energy on heating applications. Used in conjunction with a Taylor FULSCOPE* Temperature Controller, it maintains a constant temperature and eliminates the effect of time lags on drying and space heating applications. The controller sends an output pressure to the Interrupter's low pressure bellows unit. A plunger, on this unit, engages a micro-switch attached to a reciprocating, sliding plate when there is a demand for heat. As the demand diminishes, output pressure lessens and the plunger is retracted. Subsequently a point is reached where the plunger of the bellows is fixed in such a position that the current "on" and "off" period is just sufficient to maintain a constant temperature.

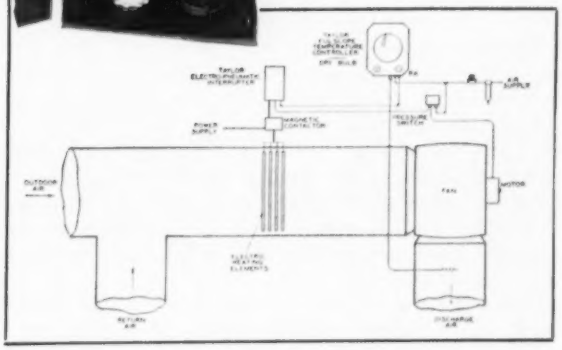


Ask your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

• • •

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

*Reg. U. S. Pat. Off.



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ACCURACY FIRST
IN HOME AND INDUSTRY

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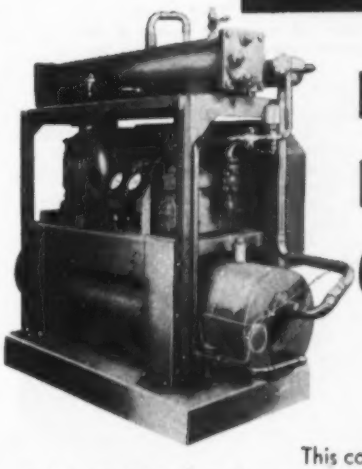


Packaged Liquid Chiller

This complete all-in-one unit is engineered to give you a superior liquid chiller in one compact assembly. It does away with extra installation costs because all assembling, refrigerant piping, wiring, evacuating, dehydrating, testing and charging are done at the factory.

Delivered ready to go to work, the NEW BAKER PACKAGED LIQUID CHILLER is built in sizes from 10 to 60 HP giving water cooling capacities of 22 GPM to 160 GPM through a 10° cooling range. If necessary to meet special requirements, complete liquid chiller units can be shipped knocked down and ready for assembly on the job.

HERE'S THE PACKAGE

Compressor, condenser, insulated dry expansion chiller, heat exchanger and motor, with accessory equipment including dual pressure control, liquid line solenoid and strainer, fusible plug or relief valve, safety thermostat and gauge board assembly. It's all there—complete!

HERE'S WHERE IT WORKS

The LIQUID CHILLER can be used to cool circulating drinking water, water for residential or commercial air conditioning, process water and other coolants for machine tools, plastics, bakeries, chemical processing, rubber compounding and countless other manufacturing applications.

A half century of refrigeration pioneering and a complete distributor service is your assurance that when you choose Baker you choose satisfaction. (Baker compressors still running after 40 years' service are not exceptional.)

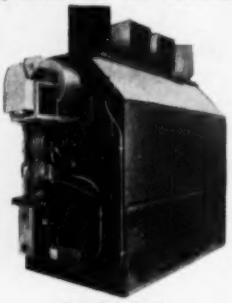
Consult your telephone classified pages for your local Baker representative. Get the full story of what this new liquid chiller will do for you.

BAKER REFRIGERATION CORPORATION
South Windham, Maine
Offices in Principal Cities

SPACE HEATER MEETS TESTING FIRM SPECS

National Champion direct-fired Heaters — heavy and light oil series — Accepted for Listing by Underwriters' Laboratories, Inc.

Listing by Underwriters' Laboratories, Inc., national testing organization, of the National Champion direct-fired Space Heaters, heavy and light oil series, has been announced by Tim J. Costello, president of the National Heater Company, national manufacturers of oil, gas and combination oil-gas fired heating equipment with headquarters in St. Paul, Minnesota.



Model "H"

Equipment listed by the testing firm meets requirements for safety both from the standpoint of electrical control sequence and the safe fire box surface and casing temperatures to qualify on minimum clearance specifications.

Designed for large area heating, National Champion units are produced in 12 models with capacities ranging from 200,000 to 2,000,000 BTU per hour.

Heavy duty industrial units

Prominent in the National Champion line is the Model "H", a vertical unit equipped with discharge heads, specifically designed for permanent spot heating of large enclosed areas or for use in industrial and commercial construction where permanent heating facilities have yet to be installed.

The National Champion line also includes the Model "D", a highly compact unit specifically engineered for the requirements of central heating systems essential in churches, schools, auditoriums and offices.

Specialized for specific problems

Other heaters in the line are the Model "I", an inverted unit with heat discharge at the bottom; Model "C", a horizontal ceiling suspension heater; Model "P", a portable unit with capacities from 200,000 to 1,800,000 BTU per hour; and the Model "S", a unit similar to the Model "D" but with side-mounted blowers.

All National Champion heaters incorporate the famous teardrop design stainless steel firebox, are of welded one-piece steel construction and utilize to advantage the direct flame-metal-air principle of heat transfer for maximum efficiency.

Burner units listed

All National Champion oil burners are pressure type and carry additional U.L. Listing for added safety. Electronic flame failure control is standard equipment. All units are wire and flame tested at the factory before shipment.

Information and specifications are available upon request from the National Heater Company, 2184 Cleora Avenue, St. Paul 4, Minnesota.

NATIONAL HEATER COMPANY

2184 Cleora Avenue **St. Paul 4, Minnesota**

Adherence to the Standard is strictly on a voluntary basis and is in the interest of obtaining uniform standards in the industry.

The 24-page booklet is available from the American Society of Refrigerating Engineers, 40 W. 40th St., New York 18, at $1.00 a copy.

Gas Transmission Piping

Gas Transmission and Distribution Piping Systems is Section 8 of the American Standard Code for Pressure Piping published by the American Society of Mechanical Engineers. This Code represents a standard of minimum safety requirements for: the selection of suitable materials; the designation of proper dimensional standards for the elements comprising piping systems; the design of the component parts; the erection of these systems, and the test of the elements before erection and of the completed systems after erection.

This latest section on gas transmission and distribution covers standards and specifications of materials, a technical discussion of piping components, description of various types of pipe joints, fabrication details and requirements after installation. One chapter contains tables of materials specifications and illustrations of several types of piping.

Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, the pamphlet is priced at $1.25 a copy.

Air Pollution in New Haven

A ten-month survey conducted for the City of New Haven, Conn., for the purpose of defining its air pollution problem has been completed by Industrial Hygiene Foundation and a report, *The Nature of the Air Pollution Problem in the City of New Haven*, presented to the city officials. The purpose of this survey was to define the problem in that city to assist the board of aldermen toward a decision on enacting a control ordinance.

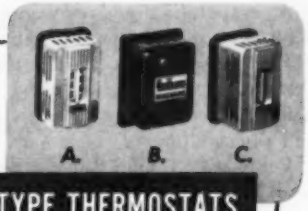
The report includes a complete inventory of stack dust emissions and an estimate of their relative importance in contributing to city dust fall. The pollution intensities of various sections of the city are compared with each other and with similar cities. The report describes the nature of measures that would be required further to improve conditions, the degree of betterment that might be expected, and the nature of the burden that would be imposed on the community and its industries in the event such an ordinance is enacted.

Copies of the report are available on request from Eric W. Mood, Director of Environmental Sanitation, Dept. of Health, City Hall, New Haven, Conn.

Dairy Plant Operation

Greater efficiency in dairy plant operation and in the selection, installation and management of equipment is the subject of the second edition of *Dairy Engineering*, written by Arthur W. Farrall, head of the department of agricultural engineering at Michigan State College. In surveying every aspect of this industry, the author has included new material on plant design, waste disposal and sanitary construction. Also included is data on steam boilers, designs for continuous butter making equipment,

A. TYPE B2
B. TYPE B4
C. TYPE B3A



SENSITIVE ROOM TYPE THERMOSTATS FOR DOMESTIC OR INDUSTRIAL USE

The three wall mounting thermostats illustrated, provide precise, sensitive control for domestic or industrial heating, air conditioning or cooling systems. Enclosed in smartly styled housings, they will fit into the decorative schemes of homes, offices or industrial plants. Two of the controls, the Type B2 and Type B3A are available in skeleton form for applications which do not require an enclosure. The specifications for the Type B2, B3A and B4 are covered by Bulletin #1-1. Send for it today.

UNITED ELECTRIC CONTROLS COMPANY
87 School Street, Watertown, Mass.
STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

KEYNOTES

"Next time get Key-Tite, the permanent seal that breaks easily."

The perfect seal for pipe joints that carry water, gas, low-pressure steam, etc.

Write for FREE Sample!

SEALS TIGHT... BREAKS RIGHT!
A Product of KEY COMPANY
2617 McCosland • East St. Louis, Illinois

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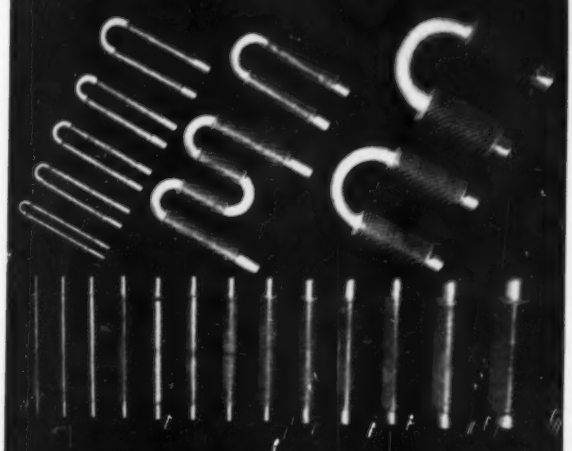
IDEAL SURFACE FOR HEAT TRANSFER



Over 100 sizes in production!

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TURNEY RADIATOR COMPANY
209 CANAL STREET • ROME • NEW YORK

MAID-O'-MIST Balancing Valve ADAPTER UNITS

convert tees into balancing valves!

No. 14 — for copper or bronze tees. Nominal pipe sizes ⅜", ½", ¾", 1".

No. 15 — for cast iron tees. Sizes ½", ¾", 1", 1¼".

These new units are quickly soldered, sweat-fitted or screwed into tees. No restriction of hot water flow except for balancing needs.

• *For baseboard radiators* • *For convector radiators*

PROMPT DELIVERY FROM YOUR JOBBER, OR WRITE DIRECT.

MAID-O-MIST INC.
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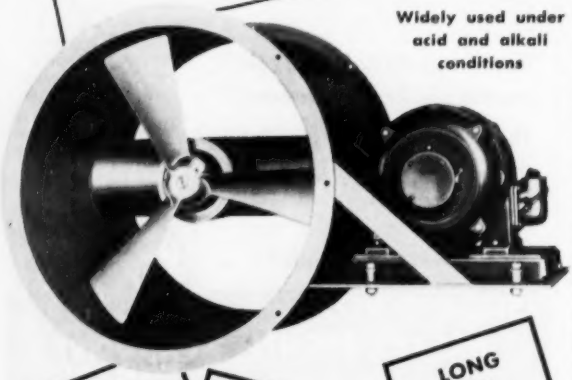
AUTOMATIC HUMIDIFIERS FOR ALL TYPES OF HEATING SYSTEMS

EXPEL GASES, EXPLOSIVE FUMES AND DUSTS
with Propellair "CS" Fans



Widely used under acid and alkali conditions

HIGH EFFICIENCY
LOW MAINTENANCE
LONG LIFE

■ Propellair's "CS" Fan is a rugged, heavy-duty unit for duct installation. The cast aluminum airfoil propeller is housed in a heavy-gauge steel duct section with steel belt guard and internal bearing support. All-welded construction. *R&M All-Weather Motor* located outside airstream. Sizes from 20" to 60", with certified air deliveries of 3750 to 85,000 c.f.m. Also available with corrosion and abrasion-resisting finishes and with ventilated bearings for high temperatures.

Simplified Installation
Propellair "CS" Fans are built to fit standard duct sizes without the need of elbows. The fan drum has front and rear flanges drilled for easy mounting into duct system.

Write for Bulletin 3082-H. Our engineers will be glad to give you free advice on any ventilating problem.

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DIVISION OF ROBBINS & MYERS, INC.
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Man Cooler Direct Drive Sky-Blast Vaneaxial Extended Shaft

milk evaporating and drying equipment and high temperature-short time pasteurization.

The new revision also deals with the physical and chemical properties of milk, refrigeration principles, insulation and cold-storage, heaters, homogenizers, and bottle and can equipment.

Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, the second edition contains 477 pages and is priced at $6.00.

Compressed Air Power

Compressed Air Power in Industrial Production is the third in a series of engineering studies of the educational program being sponsored by the Compressed Air and Gas Institute. The first two pamphlets were *Compressed Air Power*, a general survey, and *Compressed Air Power in Construction*.

This latest pamphlet is directed to designers, engineers and production men in industrial plants. It discusses pneumatic tools and aids to production, so that such men may be better able to evaluate the usefulness of pneumatic equipment. The booklet presents the many uses of compressed air in industrial production: actuation by air cylinders, agitation of liquids, blast cleaning, chipping and scaling, clamping, drilling, forging, grinding, hoisting, instrument control, molding and die casting, ramming, riveting, screw driving and nut running, spraying and others.

A 36-page pamphlet containing 63 illustrations and 13 tables, it is available at 25 cents a copy from the Compressed Air and Gas Institute, 1410 Terminal Tower, Cleveland 13.

Economics of Natural Gas

The Economics of Natural Gas in Texas tells the story of the natural gas industry with emphasis on the place of Texas natural gas in the national picture. Much information about oil, coal, water power and atomic energy is included to point out the supply and demand relationships which exist between natural gas and other fuels.

The 316-page book contains 60 illustrations and 90 tabulations. Some of the subjects covered are the utilization of natural gas, production, transportation, public control, conservation and competition with other fuels.

Authors of the book are Dr. John R. Stockton, Richard C. Henshaw, Jr. and Richard W. Graves, all of the Bureau of Business Research at the University of Texas.

The book is available from the Bureau of Business Research, University of Texas, Austin 12, and is priced at $5.00 a copy.

OTHER BOOKS AND REPORTS

TRANSPORTATION OF OIL—result of a study prepared by the Petroleum Administration for Defense. It presents analyses of probable future petroleum demands, estimated future refinery capacity, and estimated future producibility of crude oil and natural gas liquids. These factors are studied by regional areas. Minimum transportation requirements such as tank trucks, railroad tank cars, pipe lines, barges, ocean tankers and storage facilities are then projected.

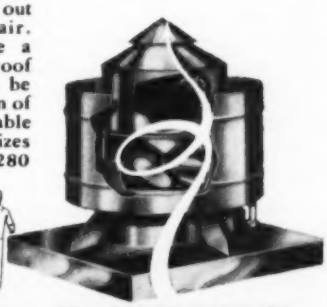
The book may be ordered from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for $1.75 a copy.

IF THE AIR IN YOUR PLANT IS

all fouled up--

MUCKLE VENTS CAN HELP YOU

No problem too tough-whether your air is London Fog thick or Sahara Dry-gaseous or dusty- smoky or hot . . . MUCKLE VENTS remove it quickly and efficiently. These streamlined, propellerdriven,roofmounted ventilators are designed with motor out of the air stream to effectively pull out either wet or dry air. MUCKLE VENTS are a completely weatherproof packaged unit ready to be installed with a minimum of expense and work, available in wide range of 15 sizes from 254 CFM to 10280 CFM.



LET MUCKLE VENTS INCREASE EFFICIENCY IN YOUR PLANT!

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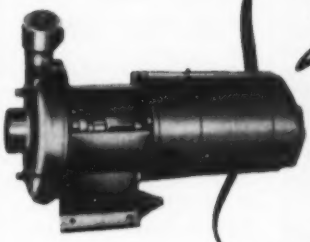
MANUFACTURING CO. OWATONNA, 8 MINNESOTA

For AIR CONDITIONING and Hot Water Circulating



Jacuzzi GENERAL PURPOSE CENTRIFUGAL PUMPS

Low cost utility pumps built for air-conditioning systems, food processing plants, circulating water for cooling towers, for sprinkling lawns, for swimming pools and hot water circulating. Choose capacity and horsepower (¼ thru 5) suited to your needs. Write for Bulletin JGP-2.

Since 1915—the industry's most complete line of pumps and water systems ...originator of jet pumps.

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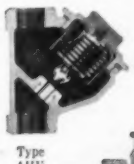
NICHOLSON TRAPS

SAVE CAR OF COAL WEEKLY

Following replacement of all steam traps, of various makes, with Nicholson units, an Eastern college reports "an average coal saving of 1 carload per week besides much better heat distribution." Credit is given the higher and more even temperatures which Nicholson traps effect. See why large industrial and institutional steam users are increasingly standardizing on Nicholsons. 5 types; for heat, power, process; sizes ¼" to 2"; pressures to 250 lbs.



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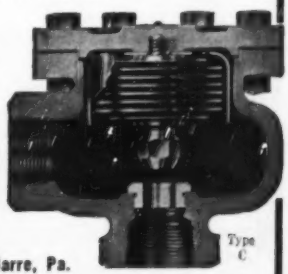

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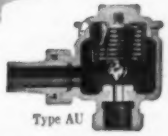

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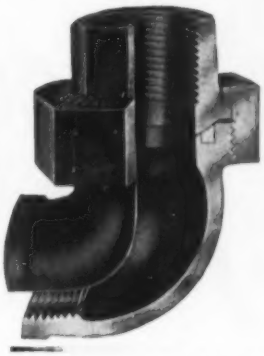

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2. Do they have octagonal ends for easy tightening by any type wrench?
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4. Are they made of Air Furnace Malleable Iron with a tensile strength of 55,000 p.s.i. and air tested before shipment?

If you can't answer "Yes" to all these questions, you're not using

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. . . . and you're not taking advantage of all these features which are back of Jefferson's reputation for high quality, maximum service and economy at a slightly higher cost.

Jefferson offers OWG 2000# to 2" and 1000# up to 4". The line includes AAR male and female unions, Endura 300#, Excel 250# and Master 150# unions. All iron seats are also available in all types.

Contact your nearest distributor or us direct for your requirements.

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RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on this page. If you write direct to the manufacturer, describe fully what you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

FOR YOUR CONVENIENCE [3-53]

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Air Conditioning Quarterly

HPAC 101—The last issue in 1952 of the quarterly, *Aspiration*, devoted its main section to a discussion of air conditioning installations in Chicago. It is liberally illustrated and valuable information on the climate in Chicago is included. Other articles cover radius of diffusion, heat relief in industry, and use of the ASHVE psychrometric chart. [Publisher: Anemostat Corp. of America, 10 E. 39th St., New York 16.]

Air Conditioning Service Manual

HPAC 102—New service manual gives detailed information on installation, initial operation and maintenance of the company's air handling and conditioning equipment. Photographs and schematic diagrams show the various phases of installation. In addition various types of fans, air conditioning units and unit heaters are described. The manual will be sent to engineers, factory executives, maintenance men or contractors who request it on their business stationery. [Manufacturer: Clarage Fan Co., Porter St., Kalamazoo 16, Mich.]

Air Power

HPAC 103—Bulletin No. 101A explains the characteristics and advantages of air power and describes three fundamental types of air control valves: the integral pilot operated, the remote controlled and the direct operated. Colored diagrammatic drawings show how the air flows through the valves to the operated cylinders. The advantages of each type, an explanation of how they work, and a list of available standard models are in-

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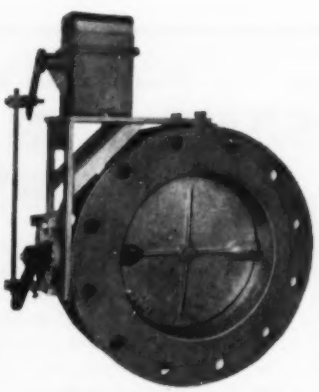

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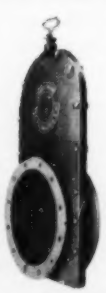

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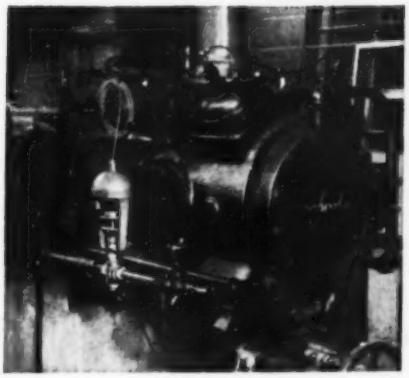

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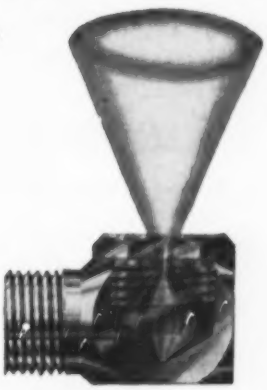

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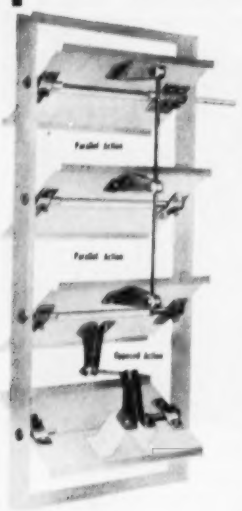

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cluded. [Manufacturer: Ross Operating Valve Co., 120 E. Golden Gate Ave., Detroit 3.]

Architecture and Air Conditioning

HPAC 104—Fourth annual reference file on application of air conditioning in architectural design. Consisting of articles written by leading independent engineers, the file covers air conditioning of hotels, auditoriums, apartment houses and office buildings as well as plants for tobacco manufacturing and food processing. [Publisher: Kinetic Chemicals Div., E. I. du Pont de Nemours & Co., Inc., 7522 Nemours Bldg., Wilmington 98, Del.]

Bar Printer

HPAC 105—Data sheet gives general information on the printer which prints continuously on any length bar or tube. Several models accommodate diameters from ½ in. to 6 in. It is recommended for codes, inspection data and trademarks. [Manufacturer: James H. Matthews & Co., 3942 Forbes St., Pittsburgh 13, Pa.]

Bilingual Manual on Wrought Iron Pipe

HPAC 106—To aid technicians in Latin-American countries and those in this country who specify for the export trade, a manual, containing data on wrought iron pipe, has been printed in Spanish and English. The bulletin lists the major uses of wrought iron for corrosive services including building, general construction, underground piping and marine applications. Tables show size and dimensional data for standard weight pipe, line and drive pipe, and extra strong pipe. Specifications cover butt-welded and lap-welded pipe, as well as diameter and length of couplings. [Manufacturer: A. M. Byers Co., Engineering Service Dept., Clark Bldg., Pittsburgh 22.]

Blast Coil Heaters

HPAC 107—Illustrated bulletin gives general descriptive data on electric blast coil heaters. Also included are construction details, diagrams of pressure drop curves, specifications and a section on magnetic contactors. [Manufacturer: Industrial Engineering and Equipment Co., 711 S. Theresa Ave., St. Louis 3.]

Blower Type Unit Heater

HPAC 108—Application Manual No. 2395 is designed for service as a handbook in selecting and applying blower type units. Complete with diagrams, drawings, illustrations and charts, the manual is divided into three sections: general descriptive, selection and application. [Manufacturer: C. A. Dunham Co., 400 W. Madison St., Chicago 6.]

Car Air Conditioning

HPAC 109—The advantages of automobile air conditioning, done in narrative style and illustrated with cartoons, is the topic of *Tsk! Tsk! Tsk! Poor Mr. Brown.* A double-page spread shows the operation of the system. [Publisher: General Motors Corp., Frigidaire Div., Dayton 1.]

Cast Steel Valves

HPAC 110—Catalog covering cast steel valves includes information on globe, angle and check valves in 300, 600, 900 and 1500 lb pressure classes. Parabolic disk valves

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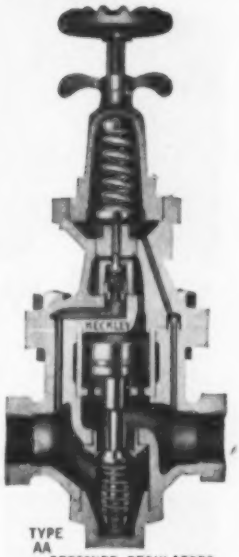

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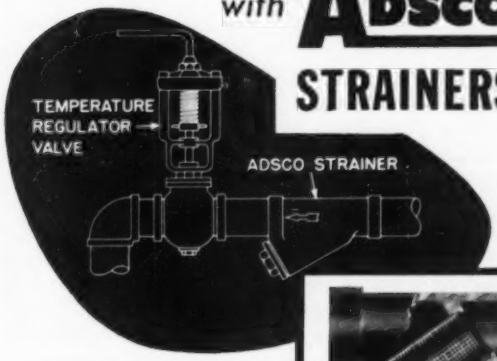

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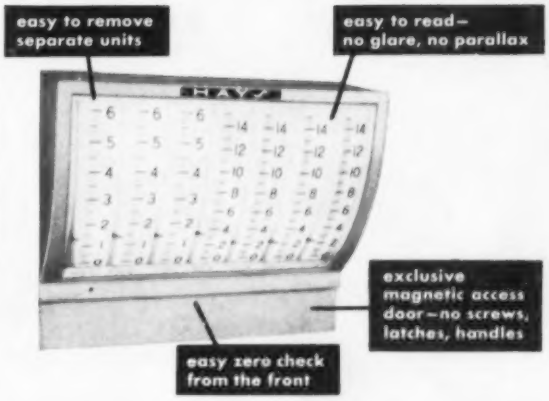
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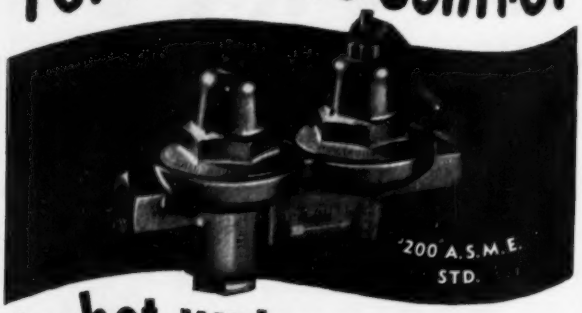

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for hand or motor control of volume are also described in detail. In addition to the standard information on construction features, dimensions, weights, etc., the booklet contains complete information on material specifications, preparation of welding ends, flange facings, pressure-temperature ratings and other technical data for valve selection. [Manufacturer: Edward Valves, Inc., Dept. CS, 1200 W. 145th St., East Chicago, Ind.]

Clay Pipe

HPAC 111—Illustrated folder describes the applications for "Screw-Seal" industrial pipe. The clay pipe uses phenolic collars and cast-on threads of Plastisol to make a tight acid-resistant joint which, according to the manufacturer can be deflected six deg without leakage. A six-page bulletin also is available with installation instructions. [Manufacturer: The Robinson Clay Product Co., 65 W. State St., Akron 9, Ohio.]

Corrosion Protection

HPAC 112—Illustrated brochure, *Where to Use Coal Tar Protection*, describes the use of coal tar in combating corrosion problems. Described are its uses in gas and oil fields, transportation and communication, water and sewage and chemical and industrial applications. [Manufacturer: Tapecoat Co., 1523 Lyons St., Evanston, Ill.]

Crowned Tooth Flexible Couplings

HPAC 113—Seven major engineering advantages of fully crowned teeth in gear type flexible couplings are described in bulletin No. 1052. Applications of "Amerigear" couplings for the solution of power transmission problems such as excessive offset or angular misalignment, space limitations, high speeds and torque loads, or problems consisting of any combination of these factors, are described and illustrated. [Manufacturer: American Flexible Coupling Co., 1810 Pittsburgh Ave., Erie, Pa.]

Demineralization of Water

HPAC 114—Bulletin 3803 describes demineralization including silica removal by ion exchange. Included is information on the chief applications, principles of operation, design features, advantages, recommendations and specifications of demineralizing and silica removal apparatus and synthetic resins. [Manufacturer: The Permutit Co., 330 W. 42nd St., New York 36.]

Draft Controls

HPAC 115—*Barometric Draft Controls — A Handbook for Installing Dealers*, is an on-the-job guide for draft control selection and installation. A 20-page pocket-sized booklet, details are also furnished on multiple installations. A question and answer section covers many common questions about draft control. [Publisher: Field Control Div., H. D. Conkey & Co., Mendota, Ill.]

Electric Heating Units and Controls

HPAC 116—Spiral-bound booklet contains data for selecting heating elements. Several types of "Thermalink" heating elements are shown and complete data sheets are given for each one. [Manufacturer: Electro-Therm Inc., Silver Spring, Md.]

Engineering Book Catalog

HPAC 117—Catalog of pocket-size technical data books

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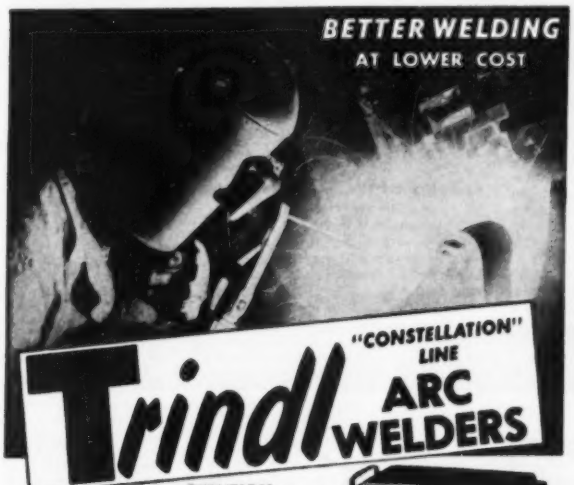

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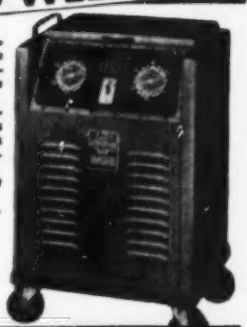

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Equipment Manual

HPAC 118—Bulletin WP-1099-B27M is a revised catalog of the company's equipment for buildings and institutions. The publication covers condensed information on sizes, dimensions, capacities, ratings, and features of air conditioning and refrigeration products; oil, gas and dual fuel engines; deaerators and deaerating heaters; water conditioning; steam turbines and turbine generators; liquid meters; centrifugal pumps, regenerative turbine pumps; vertical turbine pumps, and multi-v-drives. [Manufacturer: Worthington Corp., Advertising and Sales Promotion Dept., Harrison and Worthington Sts., Harrison, N.J.]

Evaporative Condenser Manual

HPAC 119—Bulletin on the installation, operation and maintenance of evaporative condensers gives information on theory and selection and contains schematic diagrams of various types of condensers. In addition, diagrams of piping layouts are given with tables giving performance data. Another section of the booklet contains detailed information on the maintenance of the various parts of the condenser. [Manufacturer: Baltimore Aircoil Co., Inc., 2615 Mathews St., Baltimore 18.]

High Velocity Air Distribution

HPAC 120—Bulletin discusses the engineering problems involved when using a high velocity air distribution system. One of the advantages pointed out is that higher velocities in sheet metal ducts make possible the use of smaller ducts thereby saving space. Among other subjects covered are the supply air system, duct air velocity, static pressure, duct system, fan selection, and air volume control and distribution equipment. [Publisher: Barber-Colman Co., 1228 Rock St., Rockford, Ill.]

Industrial Controls

HPAC 121—Catalog F 3941-2 on industrial controls covers control terminology, thermostats, proportioning pressure switch, humidity controls, types of valve bodies, motor-operated valves, solenoid valves, valve capacities, temperature regulators, control motors, relays, electrical accessories, heating and air conditioning controls and other products. [Manufacturer: Barber-Colman Co., Controls Div. 1228 Rock St., Rockford, Ill.]

Motor Controls

HPAC 122—Twenty-eight page bulletin describes controls, starters and accessories and a list of the applications. One section of the booklet is devoted to photographs of the manufacturing process. Requests should be addressed on company letterhead. [Manufacturer: Allen-Bradley Co., 1335 S. First St., Milwaukee.]

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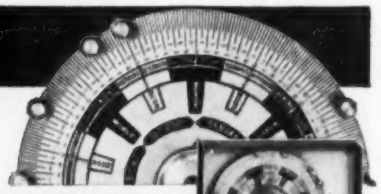

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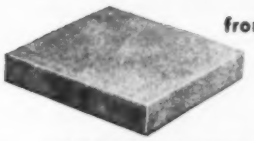

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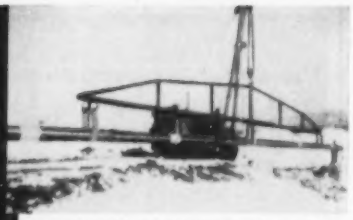

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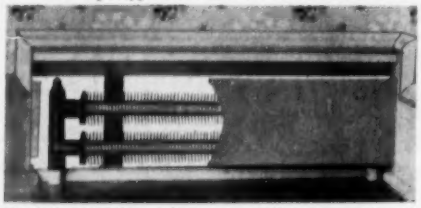

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Performance Flow Test Kit

HPAC 123—A portable, wide-range flow test kit for laboratory research and field flow checking work is described in catalog 33. The kit consists of five "Pyrex" brand glass "Tri-Flat" metering tubes with five spherical constant-density floats and instruction handbook. The handbook contains a compilation of performance data for the metering elements. In addition to describing the work of the kit, the catalog contains a table showing meter capacities. [Manufacturer: Fischer & Porter Co., 600 County Line Rd., Hatboro, Pa.]

Pillow Blocks

HPAC 124—Bulletin A-620, *All-Steel Dodge-Timken Pillow Blocks*, contains complete technical information and a large cut-away view in four colors showing the component parts in detail. A selection table for any particular application is included. The engineering staffs of the Dodge Mfg. Corp. and the Timken Roller Bearing Co. collaborated in its development. [Manufacturer: Dodge Mfg. Corp., 500 S. Union St., Mishawaka, Ind.]

Pipeline Trencher

HPAC 125—Four-page bulletin on "Model 320" trencher contains photographs of the trencher in action. It briefly outlines the advantages and special design features. Complete dimensions and specifications, including a table of optional cutting widths, are also given. The folder may be obtained by writing on company letterhead. [Manufacturer: Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17.]

Plastic for Pipe and Fittings

HPAC 126—Folder describes "Boltaron," a non-plasticized polyvinyl chloride. It is used in sheet form, bar stock, pipes, pipe fittings and in various fabrications. The folder describes its mechanical, electrical, and thermal properties. In addition, a table showing its chemical resistance is included. One section is devoted to typical fabrications. Complete specifications are given. [Manufacturer: H. N. Hartwell & Son, Inc., Park Square Bldg., Boston.]

Purifier for Compressed Air, Steam and Gas

HPAC 127—Bulletin 700, *End Dirt and Moisture Problems the Hi-eF Way*, describes the use of purifiers for live steam, exhaust steam, compressed air, vapor and gas lines. Cutaway views showing the installation of purifiers in several different applications are accompanied by descriptions of the purpose of the purifier in each case. Information also is given on the types of entrainment likely to be found in the various vapors and gases. Several photographs illustrate the effects of a purifier. [Manufacturer: The V. D. Anderson Co., Purifier Div., 1935 W. 96th St., Cleveland 2.]

Rotary Stem Regulating Valves

HPAC 128—Type "33" double-seated rotary stem regulating valves for on-off or narrow band proportional control are fully described and illustrated in a new four-page specification sheet 432. These valves are available for lever-and-weight actuation with either plain or outboard bearing construction. The new sheet gives pertinent data such as size, construction, body-temperature ratings and complete mounting dimensions. Also included are details

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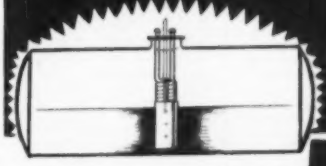

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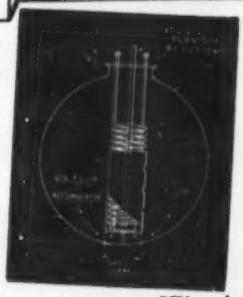

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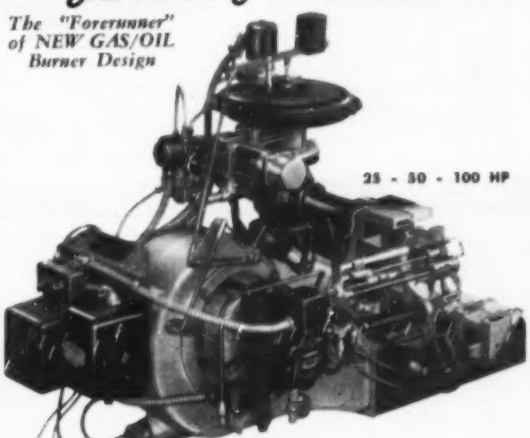

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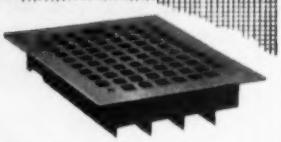

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on ordering data. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne & Windrim Aves., Station 64, Philadelphia 44.]

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HPAC 129—A new slide calculator will figure heat gain through windows. With the latitude of the building known and the compass bearing of the window, the "Sun Position, Heat Gain and Shading Data Calculator", can figure for any hour of the day and any day in the year such things as sun altitude, relative sun-window azimuth, shadow angle and so on. By changing inserts, these calculations can be made for most latitudes in the North American continent. This calculator is available to engineers and architects. There is a small charge made for it and for the extra slides for different latitudes. [Manufacturer: Ingersoll Products Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4.]

Spray Nozzles

HPAC 130—Bulletin 5200 discusses spray nozzles for air conditioning, refrigeration, heating and ventilating or similar heat transfer processes. Data given includes dimensions, capacities and spray angles. All nozzles are illustrated and some cut-away drawings show construction and operation. Blueprint drawings show proper installation. An index lists industrial applications. Requests for the bulletin are to be addressed on company letterhead. [Manufacturer: Binks Mfg. Co., 3122 Carroll Ave., Chicago 12.]

V-Belt Pump Unit for Oil Burners

HPAC 131—Catalog 107 describes a new multiple v-belt drive pump unit for industrial oil burner service. Known as type "SU", the folder shows construction features in photographs and dimensions and parts diagrams are given. Similar information is included for various other pump models. [Manufacturer: Tuthill Pump Co., 939 E. 95th St., Chicago 19.]

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HPAC 132—Diagrams and photos are used to describe the "Exidust" central vacuum cleaning system. This cleaning unit picks up dirt by means of a flexible hose and attachments and passes it through a stationary piping system to one or more collector separator tanks. An integral exhauster and motor unit provide the required vacuum. Design features and details are presented and sufficient engineering data is included in the bulletin so that a central vacuum cleaning system may be planned in detail. [Manufacturer: Lamson Corp., Billmyre Blower Div., Syracuse 1, N.Y.]

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HPAC 133—Bulletin 1000 illustrates and describes the firm's line of valves. Included are illustrations, operating and circuit diagrams, and dimensions and weights. The valves, embodying disc type construction, are used for operating air and hydraulic cylinders, single and double acting, and air motors. They are available in hand, foot, power and solenoid operated models. [Manufacturer: Ledeen Mfg. Co., 1600 S. San Pedro St., Los Angeles 15.]

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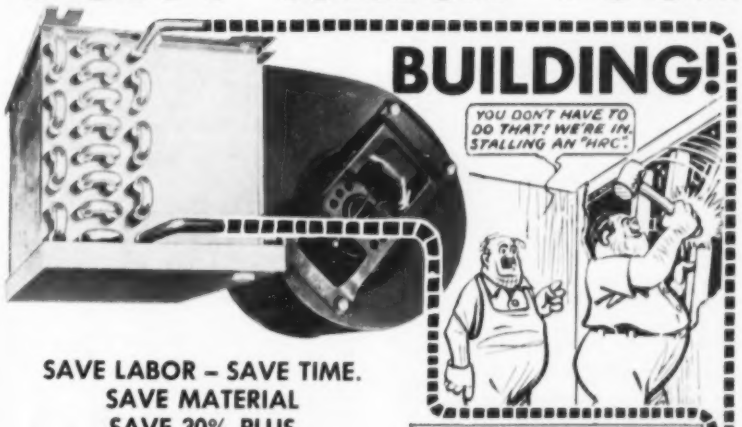

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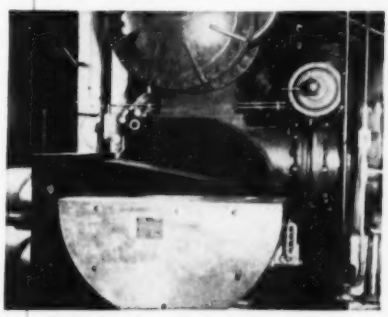
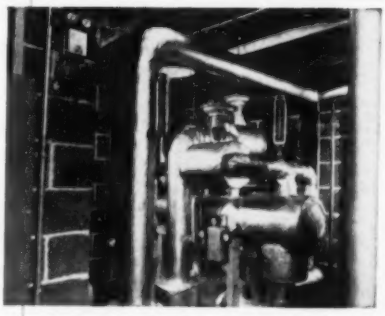
These diverse services present many different temperature regulation problems, most of which are solved *automatically* by the proper application of Johnson Control. All the way from the control of individual room temperatures, for human comfort, to the protection of delicate electronic devices associated with the safe operation and guidance of aircraft, the Johnson "Planned-for-the-Purpose", "Installed-for-the-Purpose" Control System solves the problems effectively.

The same systems which are applied to the most intricate temperature regulation problems in the nation's outstanding buildings are also available to you. Whether your building presents a multiplicity of problems or a relatively simple application of automatic temperature control, call a Johnson engineer from a nearby branch. He has the benefit of the many years of experience which has been accumulated by the only nationwide organization devoted exclusively to manufacturing, planning and installing automatic temperature control systems. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branches in Principal Cities.



Johnson T-901 Remote Bulb Submaster Thermostats, readjusted by S-222 Gradual Switches, control the capacity of each of two 350-ton Carrier centrifugal refrigerating machines that furnish chilled water for the cooling system.



Behind the scenes, in machine rooms, Johnson T-800 Master Remote Bulb Thermostats, measuring the outdoor temperature, readjust T-901 Submaster Thermostats which control V-185 Valves on the steam supply to the converters.

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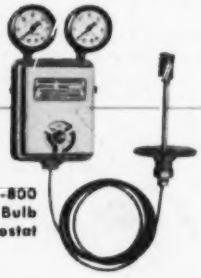

T-800 Remote Bulb Master Thermostat

T-432 Heating-Cooling Room Thermostat

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